SITES OF BIRCH WOODLAND IN THE SPEY VALLEY AND THEIR RELATIVE ECOLOGICAL IMPORTANCE

Report to the NCC (Aviemore)

C. J. Barr

Institute of Terrestrial Ecology
Merlewood Research Station
Grange-over-Sands
Cumbria
England
LA11 6JU

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A REPORT TO THE N.C.C. (AVIEMORE) ON CERTAIN SITES OF BIRCH WOODLAND IN THE SPEY VALLEY, AND AN ASSESSMENT OF THEIR RELATIVE ECOLOGICAL IMPORTANCE.

C. J. BARR, I.T.E. MERLEWOOD RESEARCH STATION

Introduction

During 1973/4, a survey of selected sites in the Spey valley was completed by staff from Merlewood Research Station. The survey was carried out in cooperation with Nature Conservancy Council staff at Aviemore, and was primarily intended to investigate the range of ecological variation present within the birchwoods of the valley. Secondarily, an assessment was required as to the ecological relationship of Craigellachie NNR and SSSI relative to the other sites.

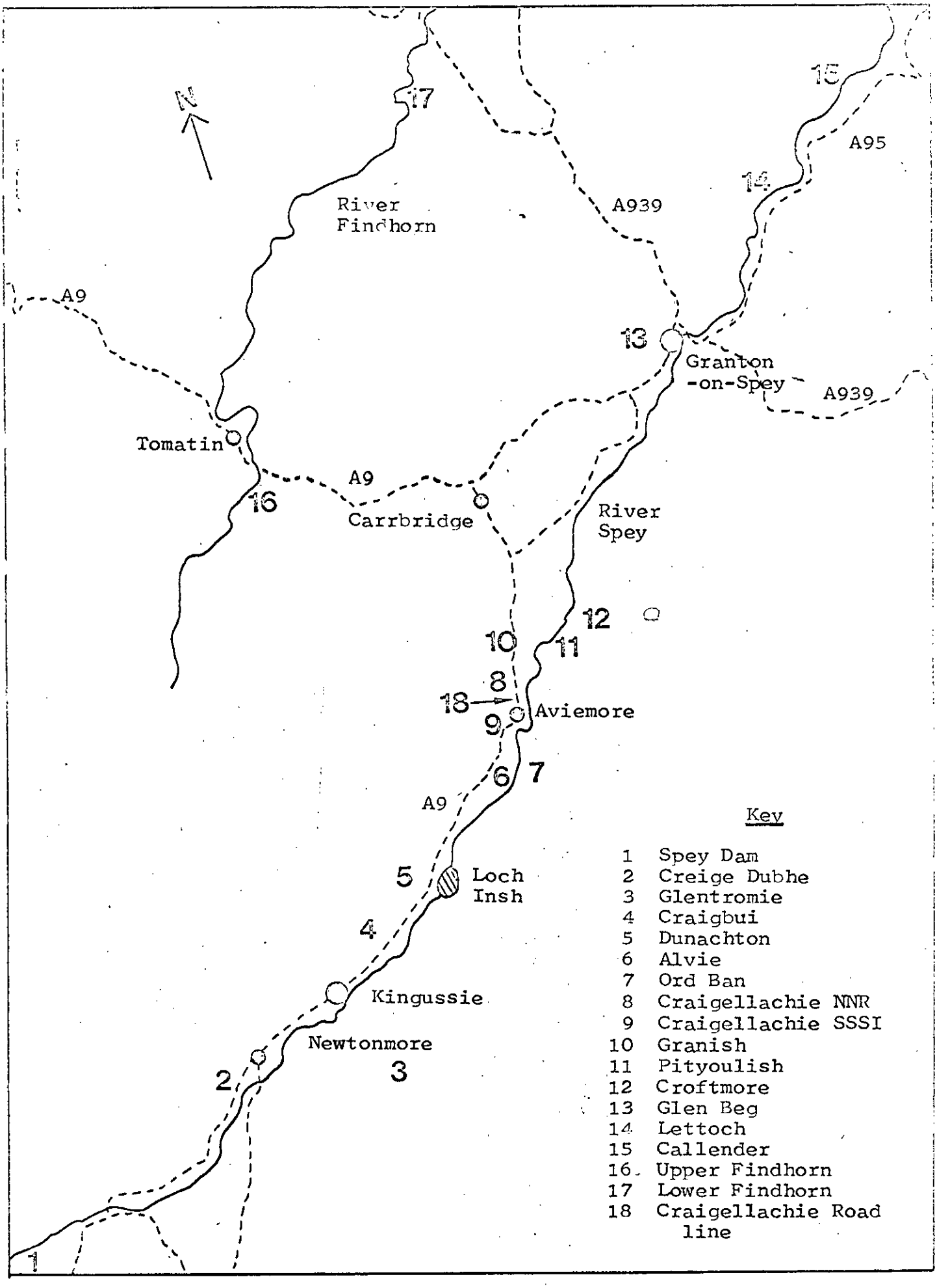
It has subsequently been suggested that further sites may require protected status to ensure the adequate representation of the Speyside birchwood series. This report attempts to evaluate the ecological characteristics of the sites, and suggest those sites that might be of interest to the N.C.C.

Methods

A full description of the field analysis methods will be given in a final report but information is quoted here that is essential to the basic understanding of the survey techniques.

A preliminary inspection of the area revealed about 50 individual birch or birch dominated sites totalling some 400 hectares. Of these, the largest woods, complemented by a selection of smaller ones, were selected for study (fig 1). Three sites in the vicinity were also included. Craigellachie was subdivided into the NNR and the SSSI, in addition to which, an area which had been intensively surveyed in connection with re-routing of the A9 trunk road, was also included as a separate site. A full list of sites is given in Appendix 1.

Map showing distribution of sites in the survey. Fig. 1



Normally 8 or 16 200 m^2 plots, were randomly located within each site and vegetation, tree, habitat and environment data were recorded using the standard survey technique developed at Merlewood. The data were analysed in several ways, but ground vegetation was used as the main parameter of variation.

Results

Some of the results that have been produced to date, and that are relevant to this report are given in Tables 1-5. It should be pointed out that most of these figures are mean values with no error terms included and do not therefore indicate within site variation.

During the course of data study, two analyses were carried out, the results of which are central to this report.

a) Reciprocal averaging ordination (Hill (1973)) which provides axes scores for each plot i.e. a continuous measure of variation, depending on the species present. This gives an excellent statistical method for comparing plots especially by reference to the first two axes, which account for most variation.

b) Indicator species analysis (Hill et al (1975)) classifies the plots into groups depending again on plant species present i.e. classification into types. The method involves splitting the data set dichotomously, so that at first two, then four, eight, sixteen, groups are produced. In this case the eight group level was considered convenient for study, and are referred to as vegetation types.

Interpretation of the ordination and the ISA groups

a) Ordination

Fig. 2 shows the position of all the plots on the first and second axes of the plot ordination. Each axis represents a trend of either a single ecological variable, or more usually a combination of such factors. As yet, insufficient work has been completed to interpret these axes fully, but the diagram shows some generalised characteristics of the different regions of the ordination, based on examination of the relevant raw data.

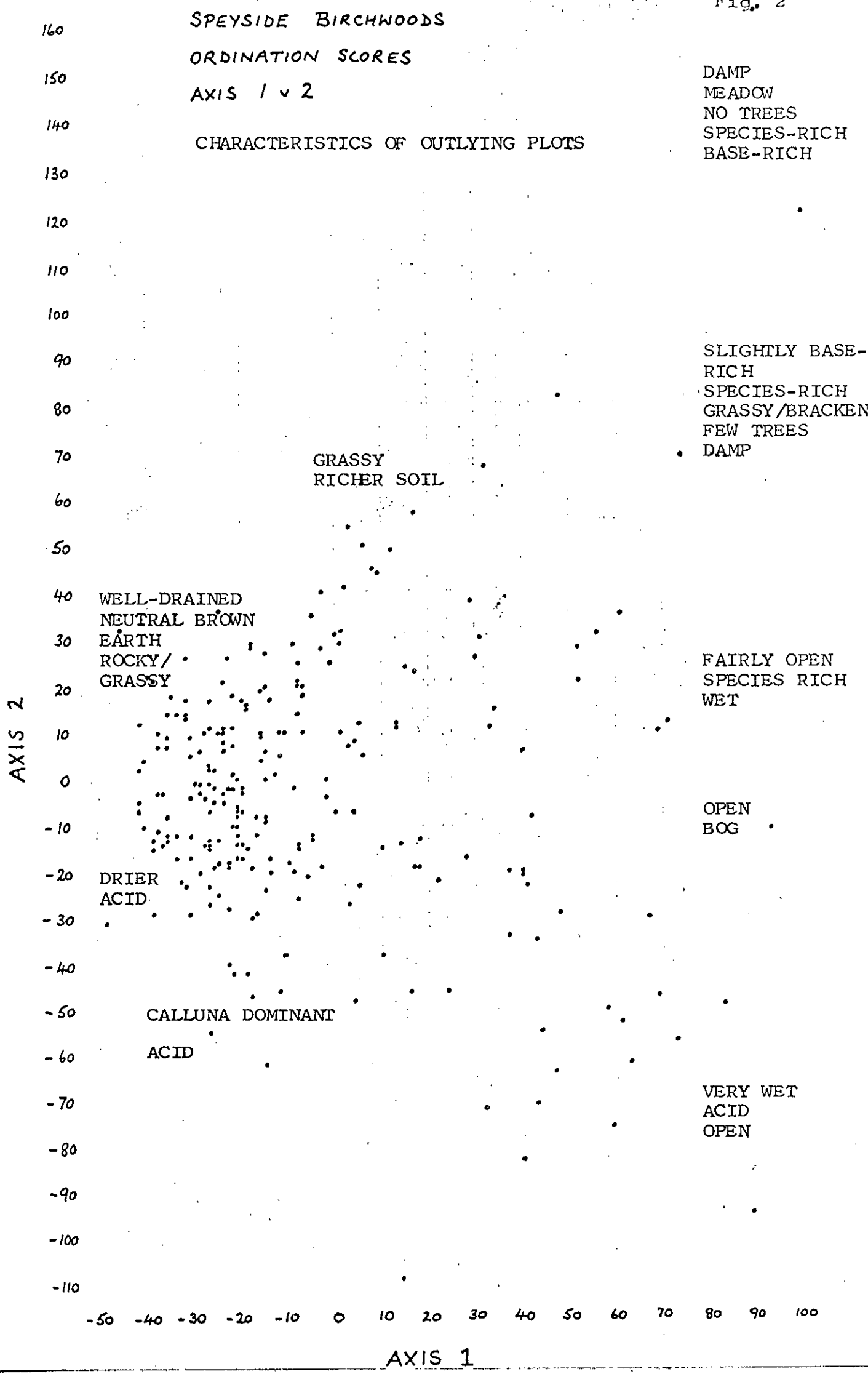
Fig. 2

SPEYSIDE BIRCHWOODS

ORDINATION SCORES

AXIS 1 v 2

CHARACTERISTICS OF OUTLYING PLOTS



It will be noticed that there is a concentration of plots on the negative end of the 1st axis. The plots which lie outside this cluster, tend to have many of the common species also present, but it is the additional rarer species that alter the overall scores and thus the position on the axes.

From this assessment, it would appear that the first axis represents a transition from dry, freely-drained conditions to damp or wet habitats. This trend is paralleled by a gradient from dense to open woodland. The second axis seems more concerned with pH, grading from acid bogs and heaths, through brown earths to relatively base-rich pastures and transitional communities.

b) Vegetation types

The distribution of the plot types in the sites is shown in Fig. 3.

From an initial inspection of the characteristics of each plot type, the following brief descriptions have been produced.
(Species in brackets are the dominant cover species and the highest selective species respectively).

Type 1 (Calluna/Vaccinium)

Acid, freely-drained podsolic type characterised by Calluna and Vaccinium species.

Type 2 (Calluna/Empetrum)

Wet, acid areas in woodland characterised by Empetrum, Molinia and Erica.

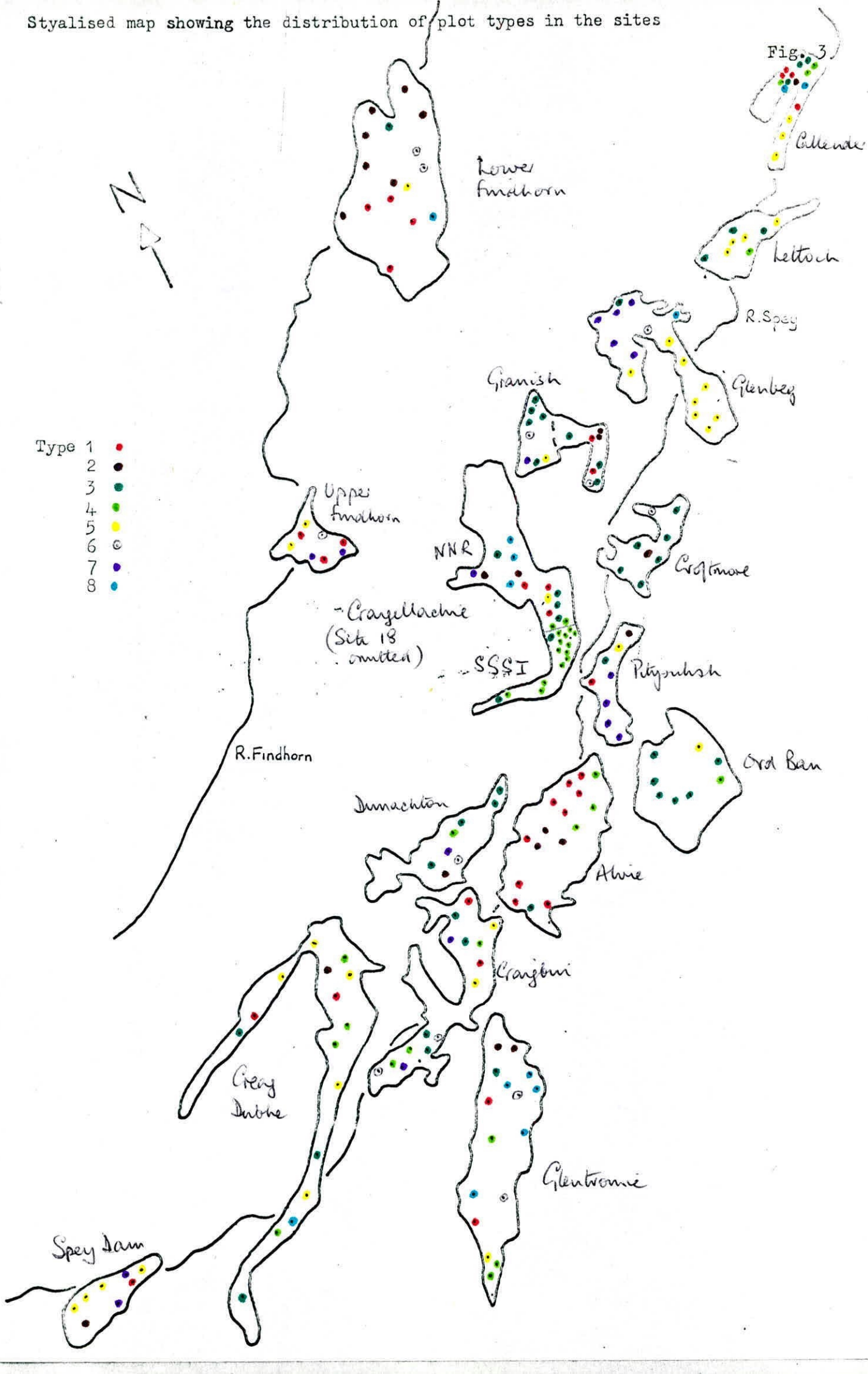
Type 3 (Calluna/Lotus)

Typical birchwood type, freely drained, moderately acid, light, brown earth with Calluna and many smaller herbs such as Lotus, Galium and Viola and grasses, Festuca, Anthoxanthum and Deschampsia.

Type 4 (Pteridium/Teucrium)

Less acid brown earths, well-drained and rocky. Pteridium and grasses are common as well as more shade-tolerant species such as Teucrium, Fragaria, Ajuga, Oxalis and Primula.

Stylised map showing the distribution of plot types in the sites



Type 5 (Pteridium/Lysimachia)

Less acid, damp and better soils under shady conditions. Viola, Galium, Oxalis, Dryopteris and Lysimachia characterise this group.

Type 6 (Anthoxanthum/Plantago)

A very distinct base-rich, species-rich, damp group typical of meadows and woodland borders, including species such as Plantago, Rumex, Achillea and Bellis.

Type 7 (Anthoxanthum/Carex)

This group is typical of soils with medium acidity under damp or streamside conditions in open woodland. Common species include grasses, Carices, Juncus, Viola and Blechnum.

Type 8 (Myrica/Narthecium)

Another distinctive type, typical of very acid, wet open moorland and woodland fringes. Characteristic species include Narthecium, Myrica, Molinia, Carices, and Juncus.

Site descriptions

The following descriptions are based solely on the data collected on the survey, and summarised in Tables 1-5, and their accuracy therefore depends partly on the number of plots surveyed.

Only the outstanding features of each wood are mentioned. Quantitative adjectives (e.g. small, high, many) are used in relation to the other site descriptions, and should not be contrasted with results from other populations. (Regeneration was defined as woody species of more than 25 cms. high but less than 6 cm. dbh. Seedlings were less than 25 cms. high).

1) Spey Dam - a small, steeply sloping upland site with a high overall species complement and a high number of species per plot. Half the plots were of vegetation Type 5. The canopy was of pure birch but no regeneration was recorded although seedlings were abundant. Many different habitats were present and the pH was relatively high.

2) Creag Dubhe - a large site which had few species per plot, although several vegetation types were present especially Types 4 and 5. The tree layer was of uneven aged birch below which there was little regeneration and few seedlings. Although the site was situated on a generally sloping aspect, the plots reflected the irregular nature of the terrain with many lying on flat ground.

3) Glentromie - a large wood with an even-sized admixture of birch with Juniper, Rowan and Alder. Regeneration was scarce but birch and Rowan seedlings were common. The site contained several vegetation types but predominantly the wet moorland Type 8.

4) Craigbui - a heterogeneous site, with a wide range of habitats, on gently sloping ground. All plots contained birch with Juniper and Alder occurring frequently. There was little regeneration but seedlings were frequent.

5) Dunachton - many vegetation types were present in this gently sloping site but predominantly the common Type 3. There was a high proportion of plots containing birch, constituting an even-aged structure. Juniper and Alder were also present with regeneration and seedlings of all species occurring frequently.

6) Alvie - a large site with fairly homogeneous vegetation dominated by Type 1. The homogeneity is expressed by the low number of species overall, and the low number of species per plot. Most plots contained birch of an even-sized structure but oak and Scots pine were present in some plots. Birch regeneration was nearly absent whereas other species were regenerating freely. Seedlings were plentiful and the total basal area of tree species was high. The site was poor in habitats and had a low average pH.

7) Ord Ban - dominated by the common Type 3, the vegetation was relatively uniform. The tree layer was of pure birch with an uneven-aged structure giving a low total basal area. Although there was no regeneration, seedlings were found in most plots.

8) Craigellachie N.N.R. - together with the S.S.S.I. this site forms one of the largest woods in the valley. There was a wide variety of vegetation types with only the meadow Type 6 not represented. There was a low basal area of mostly small-stemmed trees. A wide range of environmental measurements gave average mean values for the site.

9) Craigellachie S.S.S.I. - this part of the wood was remarkably uniform in its vegetation with most plots belonging to Type 4, the rocky, shady, dry type. The site was on steeply sloping ground with a low total basal area of smaller trees. Nearly all the plots contained birch and, although regeneration was not widespread, seedlings occurred in half of the plots. The site as a whole was poor in plant species indicative of the uniform vegetation type.

10) Granish - a small low-lying, level site with few species overall. The vegetation is dominated by Type 3 but several other types are present. The total basal area is low consisting of mostly smaller stems of birch with some Juniper, Rowan and Aspen. There is a large amount of regeneration with many seedlings.

11) Pityoulish - a small site dominated at the Southern end by vegetation Type 7, the damp neutral woodland type. Elsewhere several types are present. Birch was found in most plots, but old Scots pines and small willows were present. The overall structure showed a majority of middle sized stems with some older ones. Regeneration, more especially of other than birch species, and seedlings were frequent.

12) Croftmore - a small, shallow-sloping site at low altitude. The vegetation is mostly of Type 3 and fairly homogeneous. Nearly all plots contained birch but some Aspen and Willow were present. Most plots contained regeneration and seedlings.

13) Glenbeg - a large site containing a wide range of habitats, a high total species composition and a high number of species per plot. Most of the plots were assigned to Types 5-8, with a majority in Types 5 and 7. Regeneration was virtually absent but seedling numbers were high more especially of Rowan. The overall tree structure showed an uneven-size range with a majority of small trees. Other tree species present included Juniper, Rowan, Scots pine and willow.

14) Lettoch - a small low-lying site with a steeply sloping profile. The vegetation was uniform being dominated by Types 3 and 5. Most plots contained birch trees with some Oak and Rowan. The adult trees were fairly even aged with many older trees giving a high total basal area. There was little regeneration but a plentiful supply of seedlings.

15) Callender - a small low-lying site with a wide range of environmental factors. The vegetation was varied with most types present in even numbers. Every plot contained birch trees and additional species include Oak, Juniper, Rowan, Alder and willow, contributing to a high overall basal area with an uneven size structure. Regeneration was frequent and seedlings, especially Rowan, were plentiful. The site had a low mean pH value.

16) Upper Findhorn - a small, fairly flat, high altitude site which, despite having a wide range of habitats and vegetation types, had few species overall and few species per plot. Birch was present everywhere with Juniper, Alder and willow in some plots. The total basal area was high due to the large proportion of older trees. There was no regeneration and seedlings were not widespread. The mean pH was low.

17) Lower Findhorn - a large, level, low altitude site which was dominated by the wet woodland Type 2 vegetation. There were several other vegetation types present and a high total species count. Fewer plots contained trees than any other site, although a variety of species was present.including birch, Scots pine, Beech, Rowan, Aspen and Juniper. (Most of the trees in the site were small giving a low total basal area). Birch regeneration was very frequent and nearly every plot contained seedlings. The site had few habitats and a below average pH.

18) Craigellachie Road Lines - a very small area of the NNR with a high density of plots, the area has few species but several vegetation types. The overstorey was of almost pure birch of an uneven-size structure with Rowan also present. Birch regeneration and seedlings were both fairly common.

Discussion

a) Between site variation

Fig. 4 is a graph showing the mean positions of each site on the first and second axes of the plot ordination. The plots are positioned on each axis depending on the species complement present.

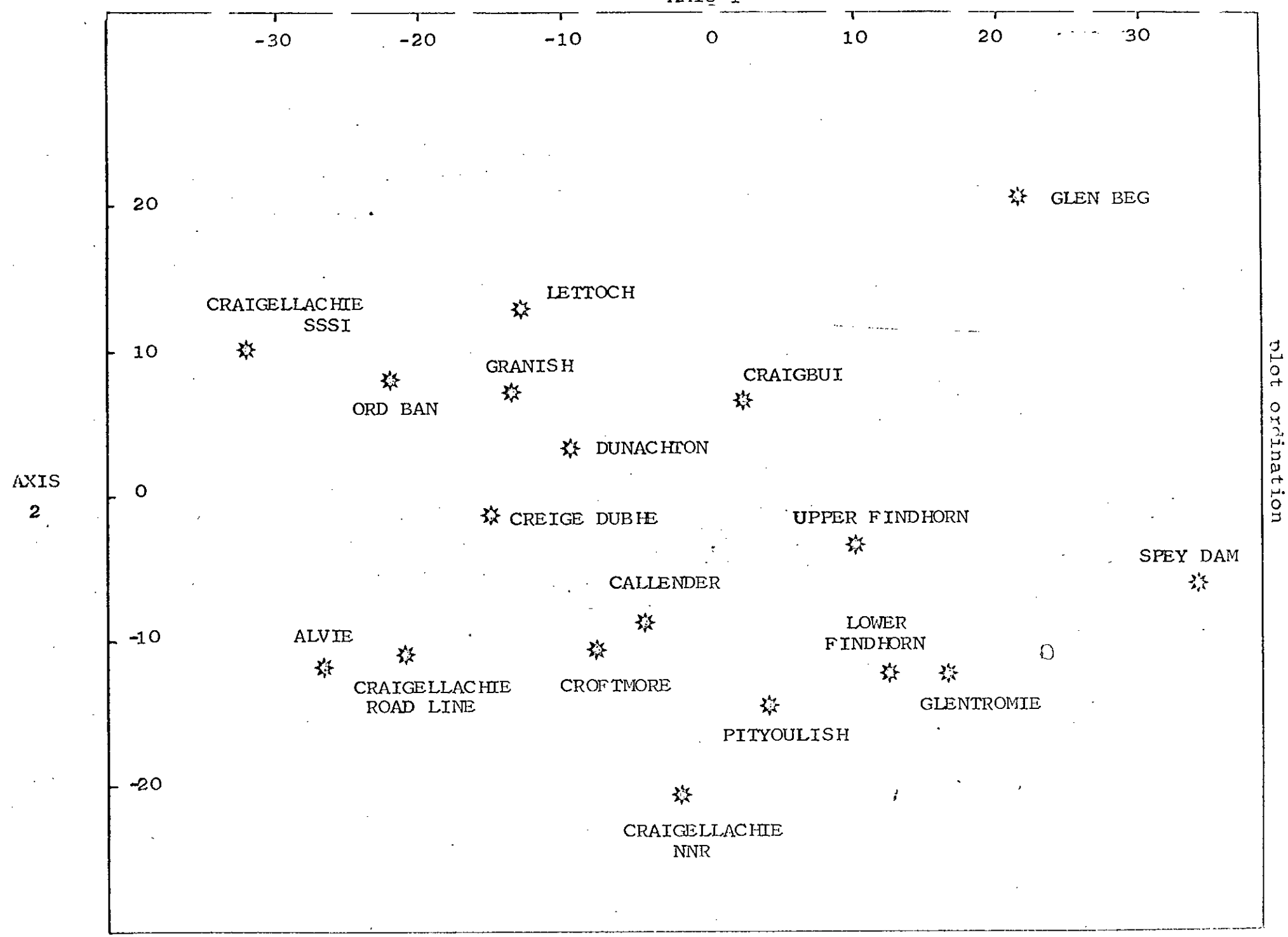
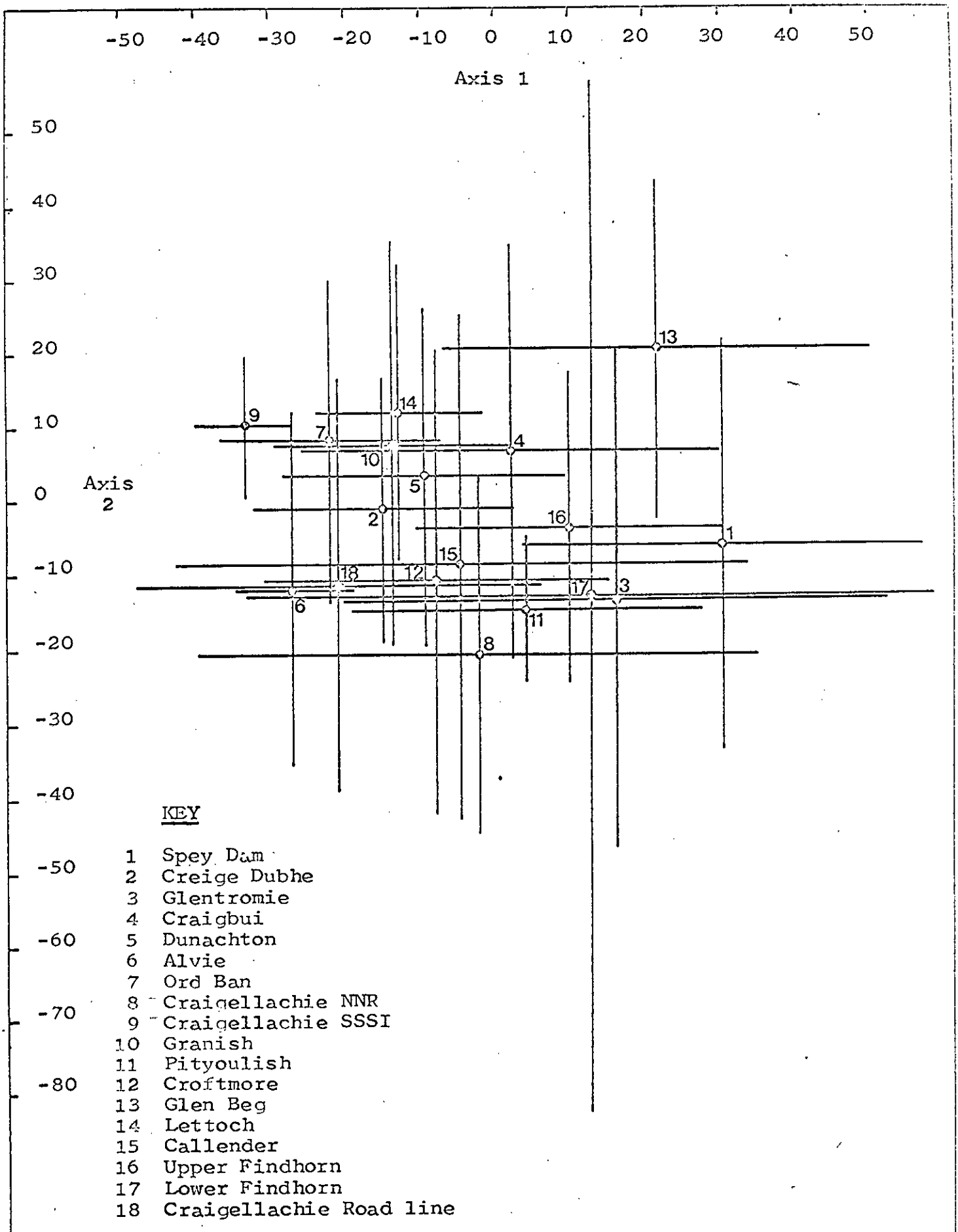


Fig. 4 Graph showing mean score of each site on 1st and 2nd axis of plot ordination

Graph showing mean scores and standard deviations for each site on 1st and 2nd axis of plot ordination

Fig. 5



If the standard deviations of the means are added (Fig. 5), thereby expressing the variation, it can be seen that the majority of the sites overlap with others. There are one or two sites which are isolated, such as Craigellachie SSSI and Glenbeg, which suggests that they contain an additional or different assemblage of plants. However woods such as Lower Findhorn and Callender appear to embrace most of the variation present in the total sample.

The conclusion from these observations, is that most of the woods in the valley are of intergrading composition.

b) Selection

To date there is only one birchwood (Craigellachie) in the Spey valley that is a National Nature Reserve. If more sites are required which would seem likely to ensure the long term conservation of the series, then it will be necessary in the first instance to select from those woods that have already been studied.

Five methods of site classification and selection are suggested and considered.

1. Woodland structure

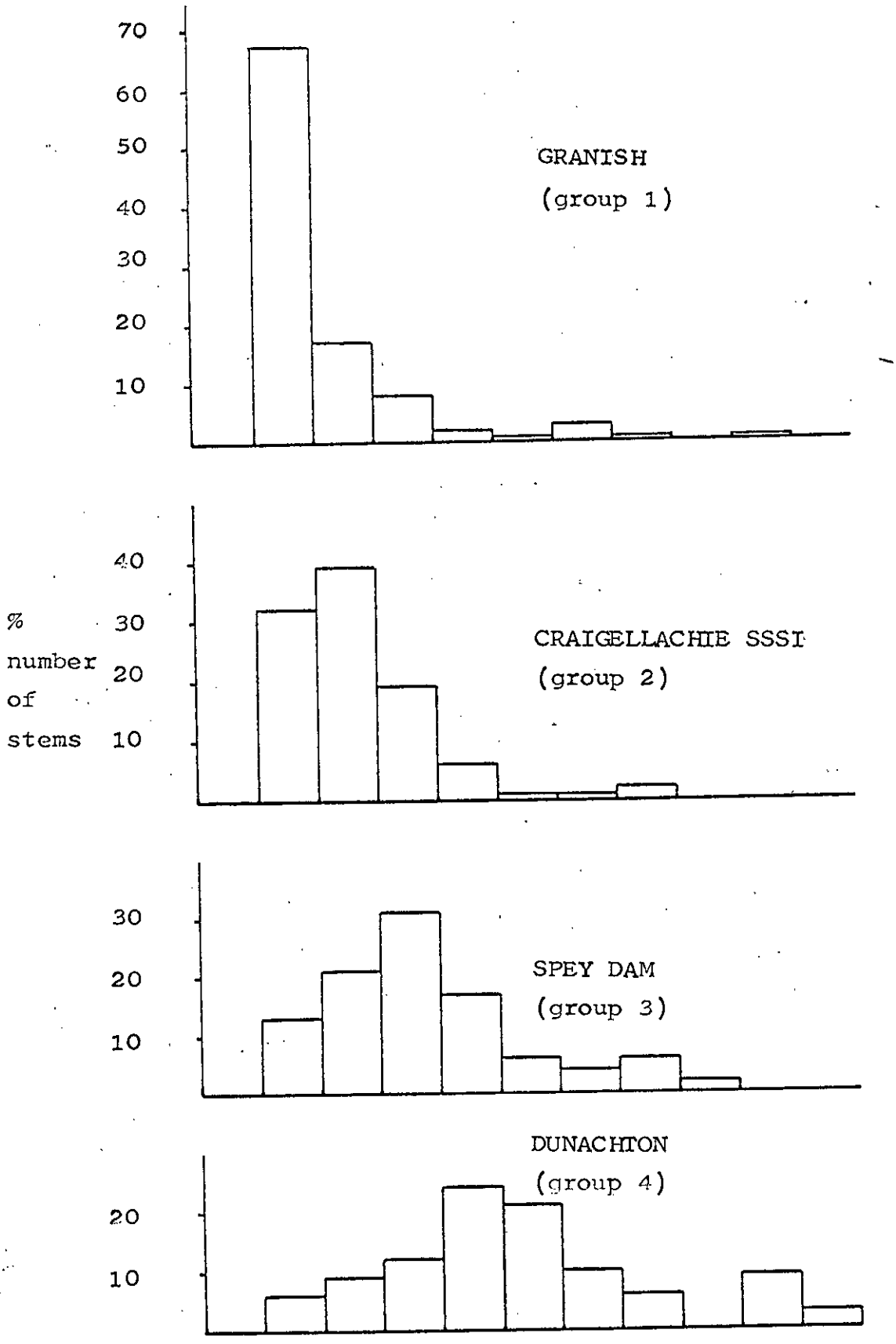
This method involves a classification of the sites according to the range and size class distribution of stems recorded in the survey. The classes are subjectively chosen to represent different stages in the development of woodland with time. A typical example of each group is shown in histogram form in Fig. 6.

Class 1 shows a majority of small stems, grading through to Class 4 with an even-size structure indicating little viable regeneration in past years.

Class 1	2	3	4
Granish	Lower Findhorn	Lettoch	Alvie
Callender	Creag Dubhe	Croftmore	Ord Ban
Glenbeg	Craigellachie Road	Craigbui	Dunachton
	Craigellachie SSSI	Upper Findhorn	Glentromie
	Craigellachie NNR	Spey Dam	
		Pityoulish	

Woodland Structure classification
- showing the structure of an example from each group

Fig. 6



Having classified the sites, then an example from each could be selected on the basis of the site descriptions, or in conjunction with one of the following procedures.

The other ways of selection consider ground vegetation and the following two methods depend on vegetation types as the units of comparison.

2. Within-site heterogeneity

In order to preserve the total range of variation in the population, then sites which contain many vegetation types might be selected, i.e. - the heterogeneous sites. The following sites contained the highest number:

Glentromie
Craigbui
Craigellachie NNR
Granish
Callender

When considering heterogeneity, it is worth considering that very homogeneous sites may also be of ecological value in that they contain pure vegetation types. Woods that have the least vegetation types are:

Craigellachie
Ord Ban
Croftmore
Lettoch

3. I.S.A. group representatives

Another way of utilising the vegetation types to express heterogeneity is to include several sites, each of which contains the highest representation of a given type. This would give a total population which included all the types present.

Below are listed those sites which contain the highest frequency of types.

5. The last method of selection involves an examination of the ordination (Figs. 7 (i - xviii) and a selection based on the premise that an ideal site for conservation is one in which there is a high proportion of the main birchwood vegetation types, together with a range of less common types to provide some range in the heterogeneity.

In the following assessment, importance is attached especially to Axis 1, since this expresses most variation. The following list ranks the sites using this procedure:

Callender
Glentromie
Craigellachie NNR
Lower Findhorn
Craigbui
Creag Dubhe
Dunachton
Pityoulish

In the final selection, the overall size of the site might be taken into account, since a larger wood is usually considered to be of higher ecological value all other things being equal. The above list might then be re-ordered so as to demote Callender.

Acknowledgement

Thanks are due primarily to Dr. R. G. H. Bunce, under whose planning and guidance the survey was completed, and to Mr. D. Morris for his assistance during the survey.

References

Hill, M. O. (1973). Reciporcal averaging: an eigenvector method of ordination. J. Ecol. 61, 237-249.

Hill, M. O., Bunce, R. G. H. and Shaw, M. W. (1975). Indicator Species analysis: a divisive polythetic method of classification and its application to a survey of the native pinewoods in Scotland. J. Ecol. 63.

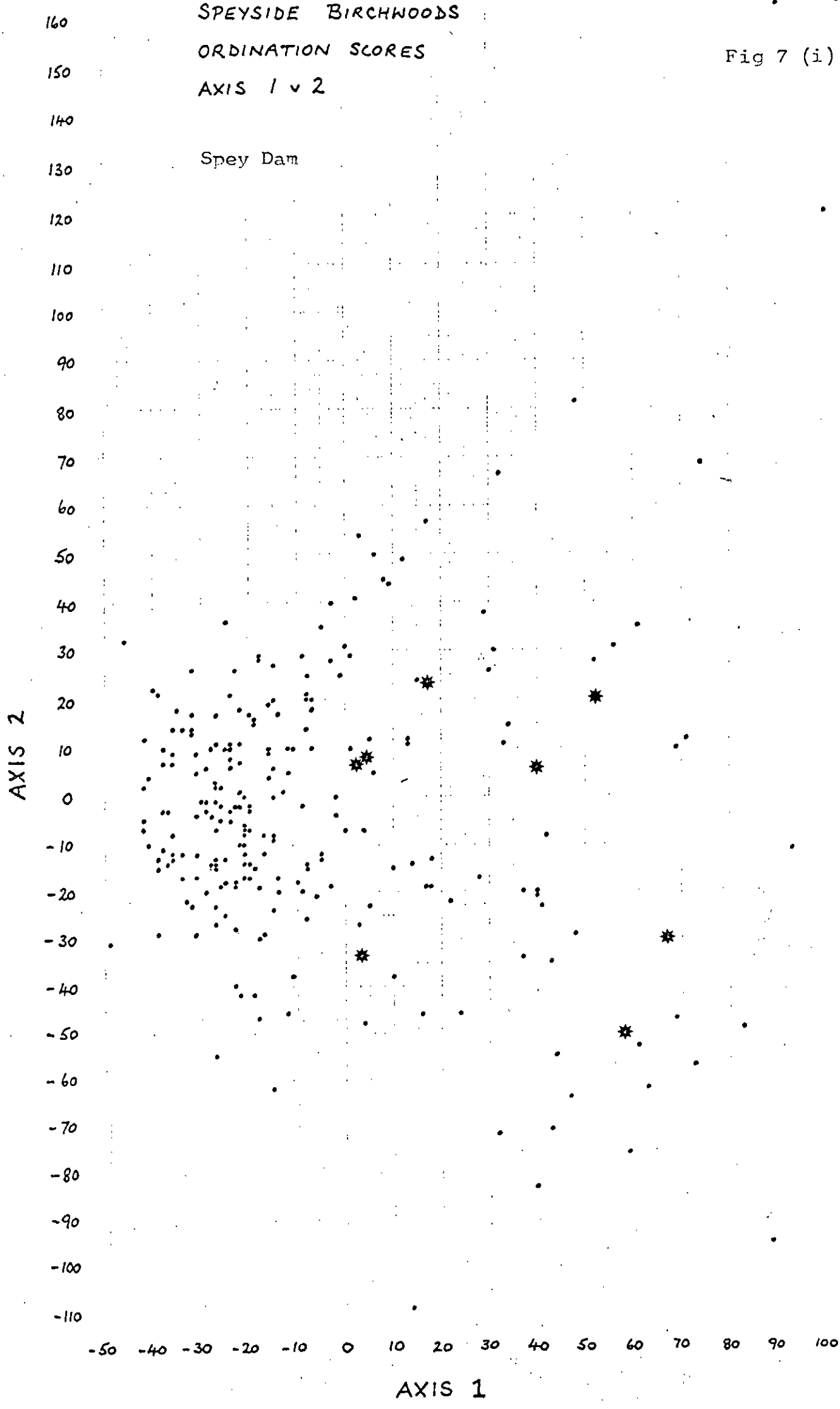
SPEYSIDE BIRCHWOODS

ORDINATION SCORES

AXIS 1 v 2

Fig 7 (i)

Spey Dam

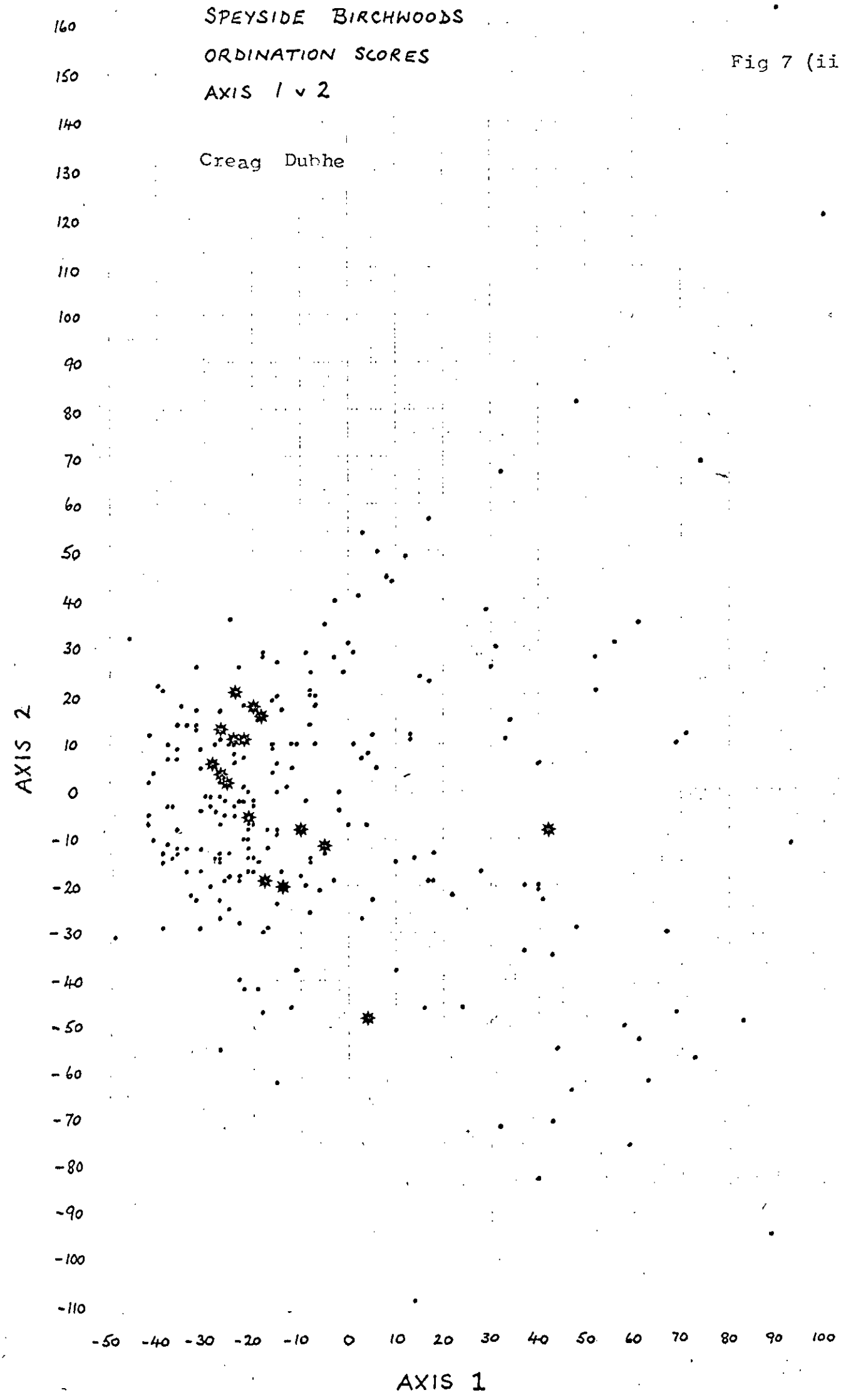


SPEYSIDE BIRCHWOODS

ORDINATION SCORES

AXIS 1 v 2

Fig 7 (ii)



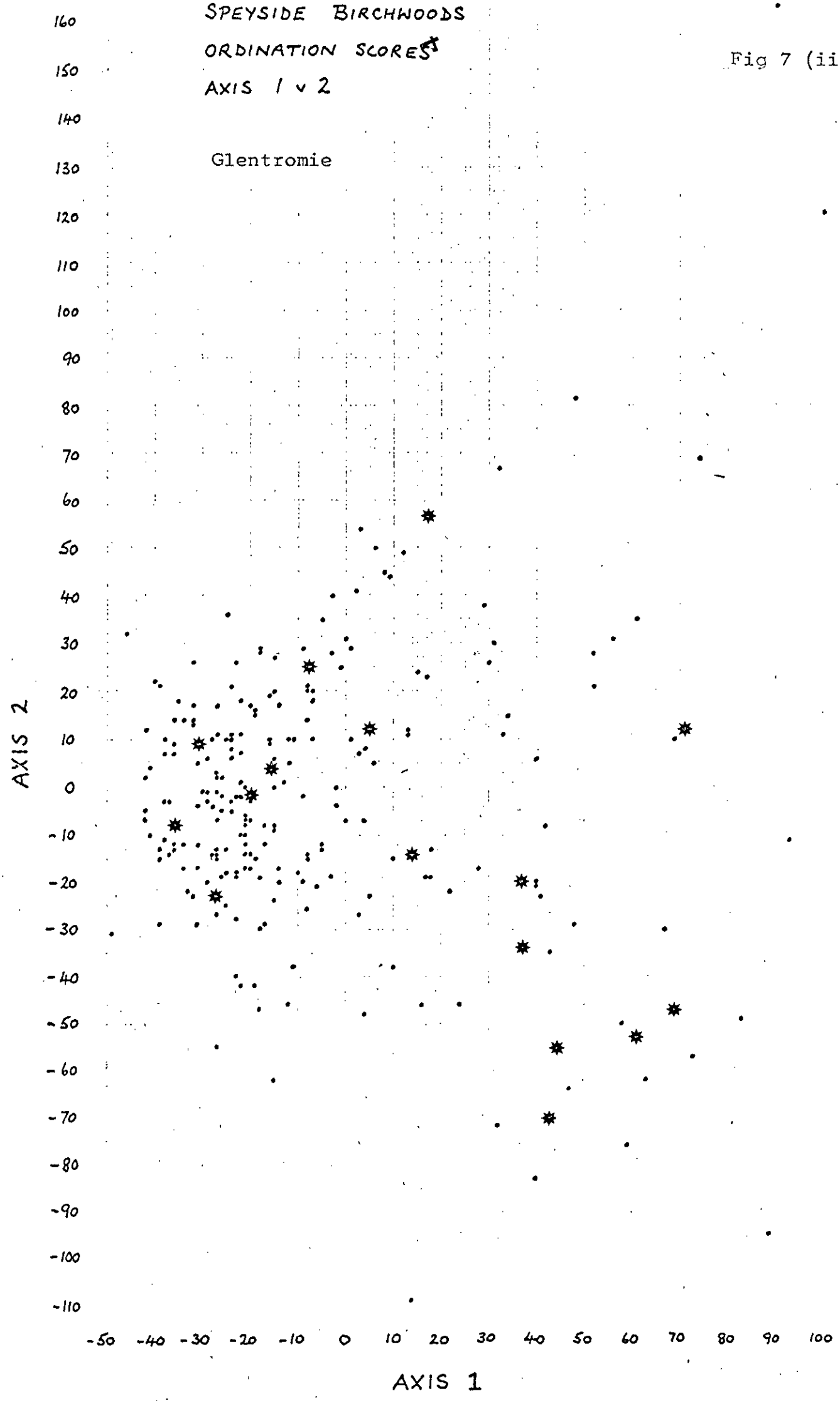
SPEYSIDE BIRCHWOODS

ORDINATION SCORES

AXIS 1 v 2

Fig 7 (iii)

Glentromie



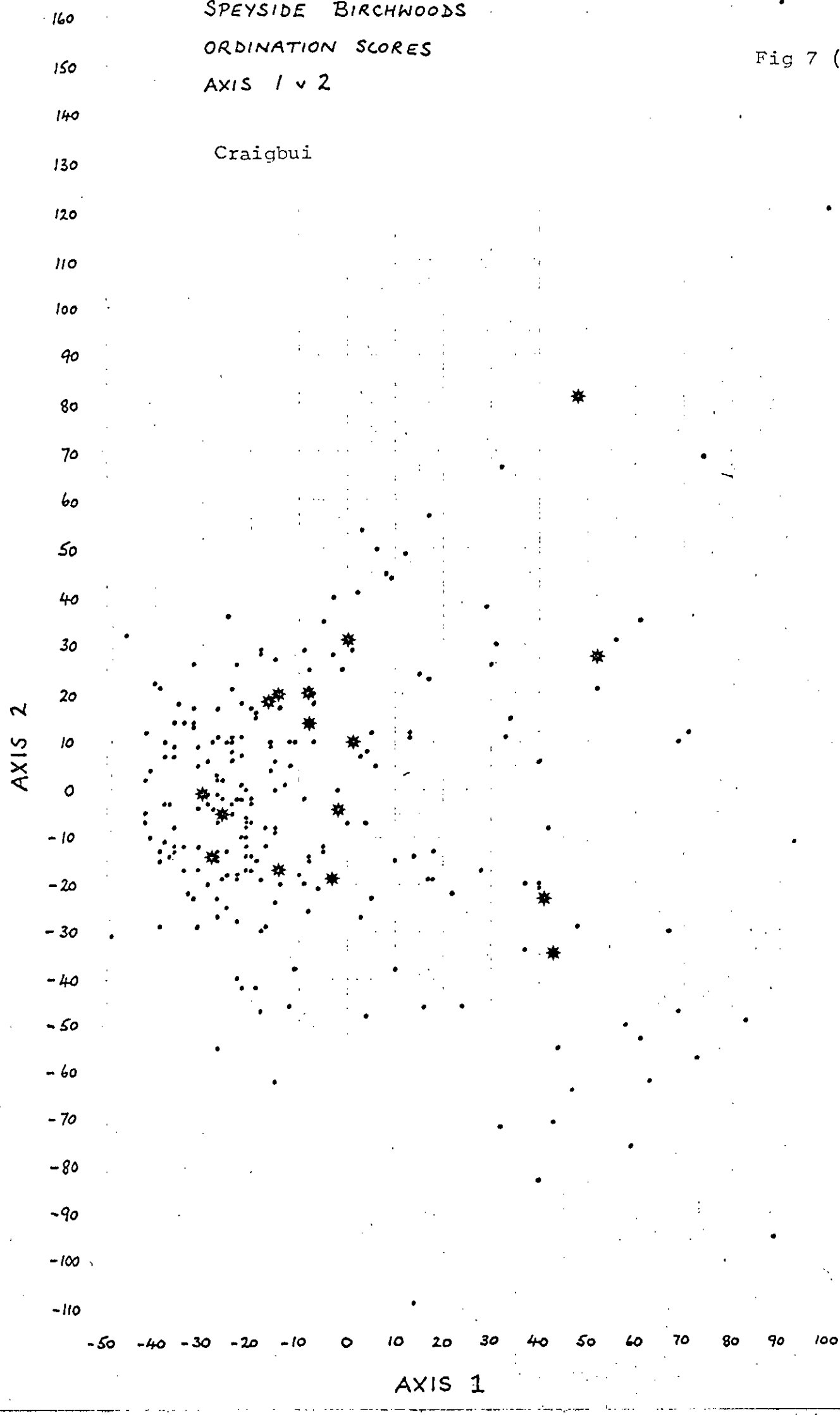
SPEYSIDE BIRCHWOODS

ORDINATION SCORES

AXIS 1 v 2

Fig 7 (iv)

Craigbui

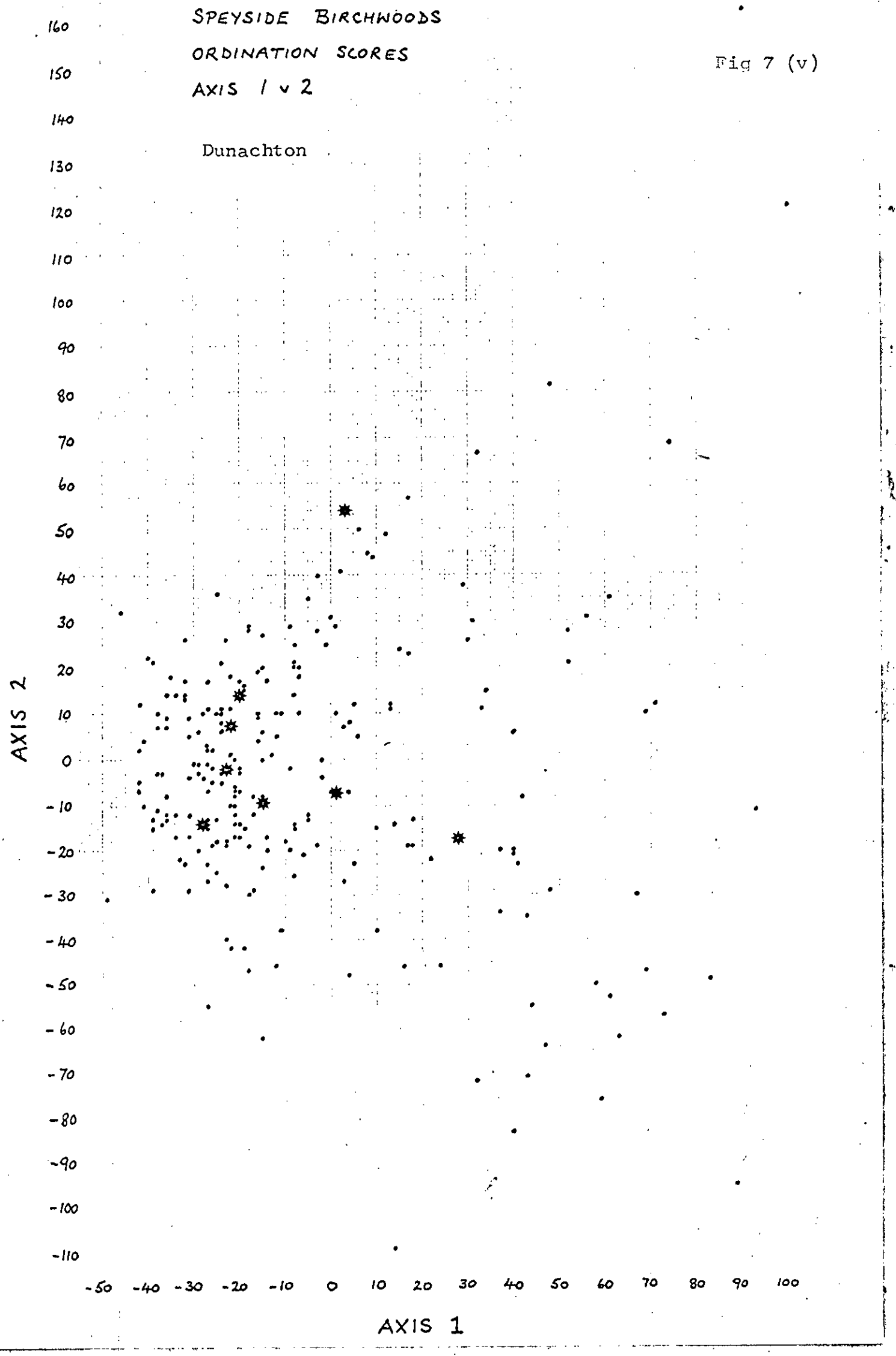


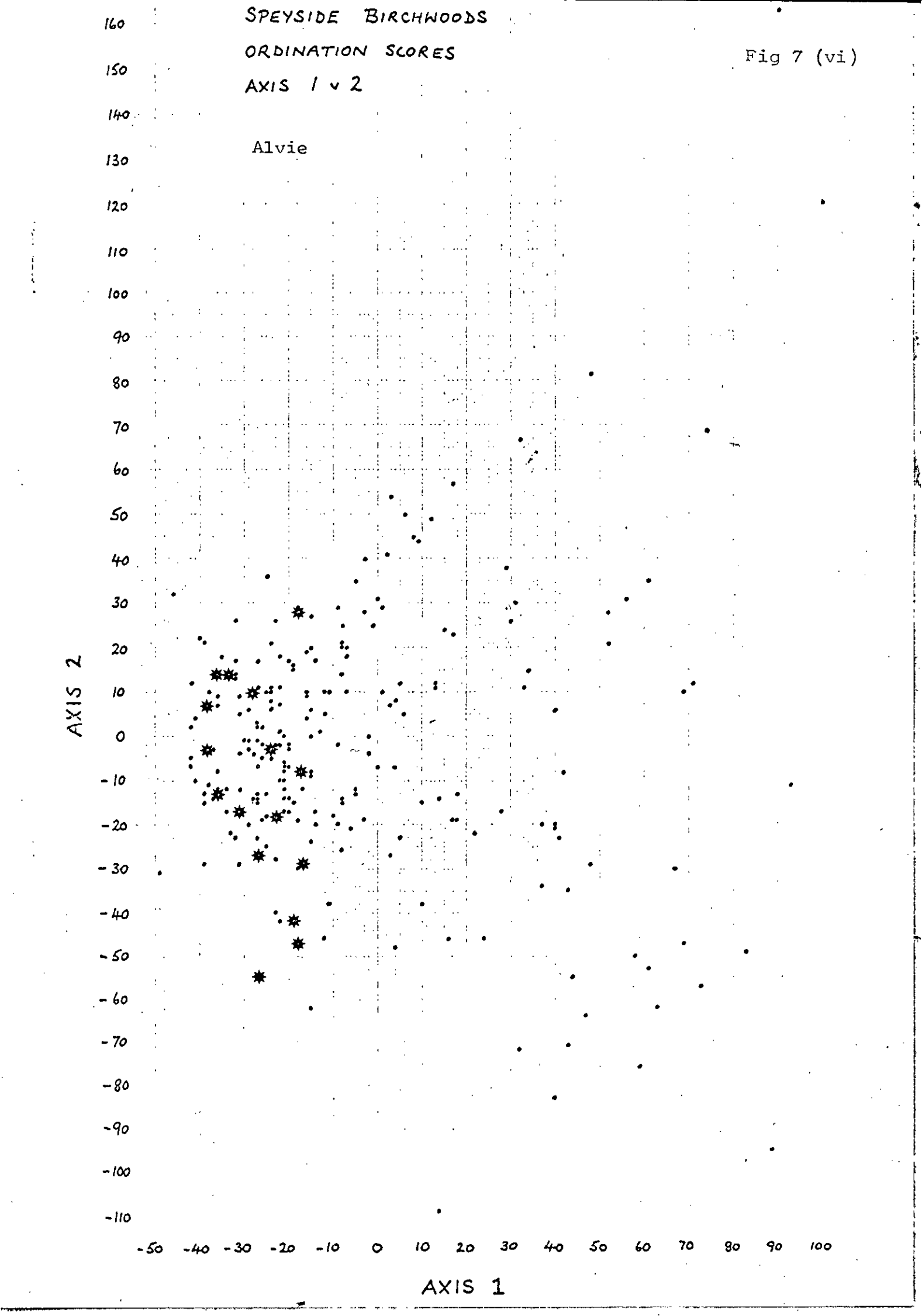
SPEYSIDE BIRCHWOODS

ORDINATION SCORES

AXIS 1 v 2

Fig 7 (v)




SPEYSIDE BIRCHWOODS
ORDINATION SCORES
AXIS 1 v 2
Alvie
Fig 7 (vi)
160
150
140
130
120
110
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90
80
70
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50
40
30
20
10
0
-10
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-40
-50
-60
-70
-80
-90
-100
-110
AXIS 2
-50 -40 -30 -20 -10 0 10 20 30 40 50 60 70 80 90 100
AXIS 1

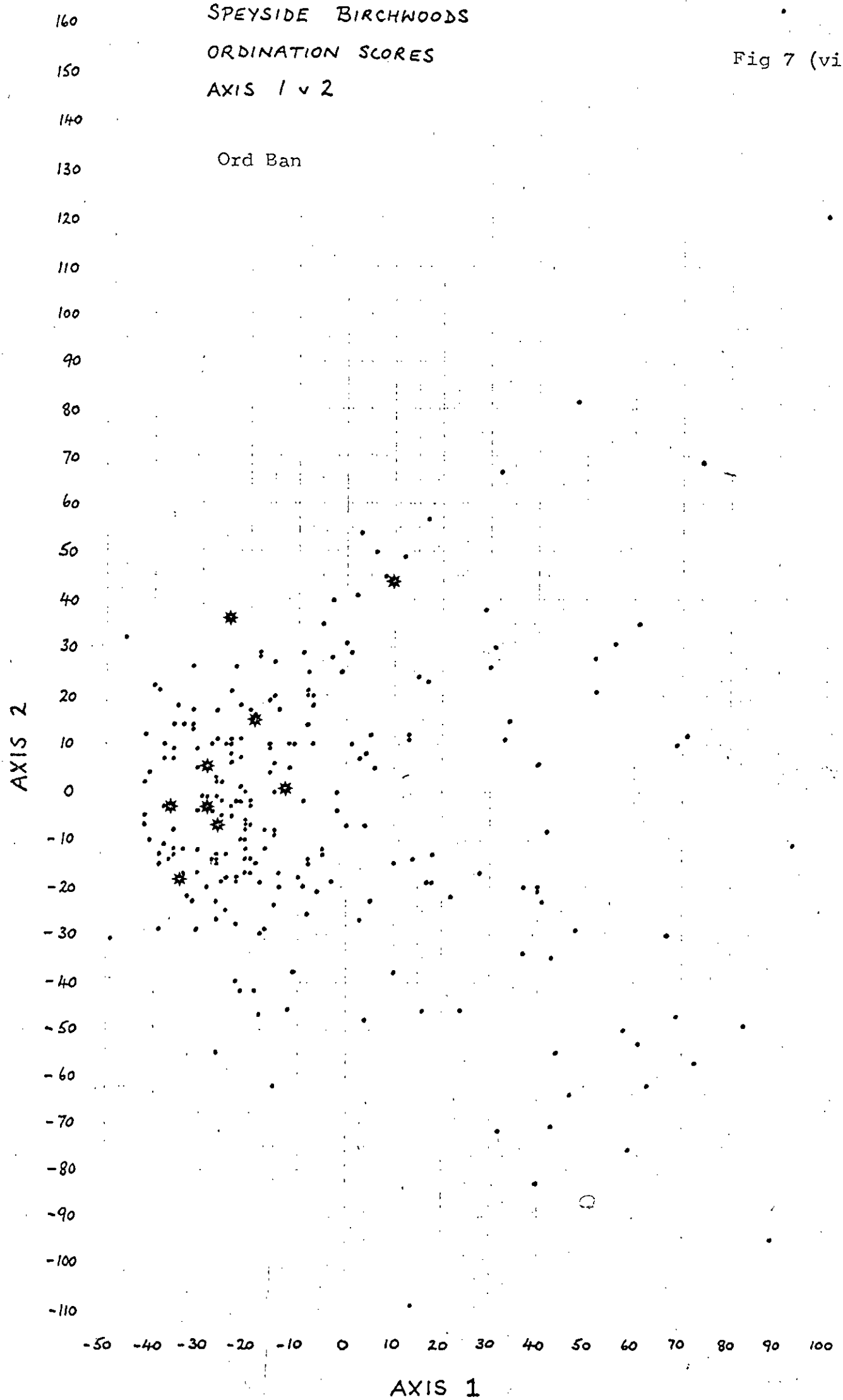
SPEYSIDE BIRCHWOODS

ORDINATION SCORES

AXIS 1 v 2

Fig 7 (vii)

Ord Ban



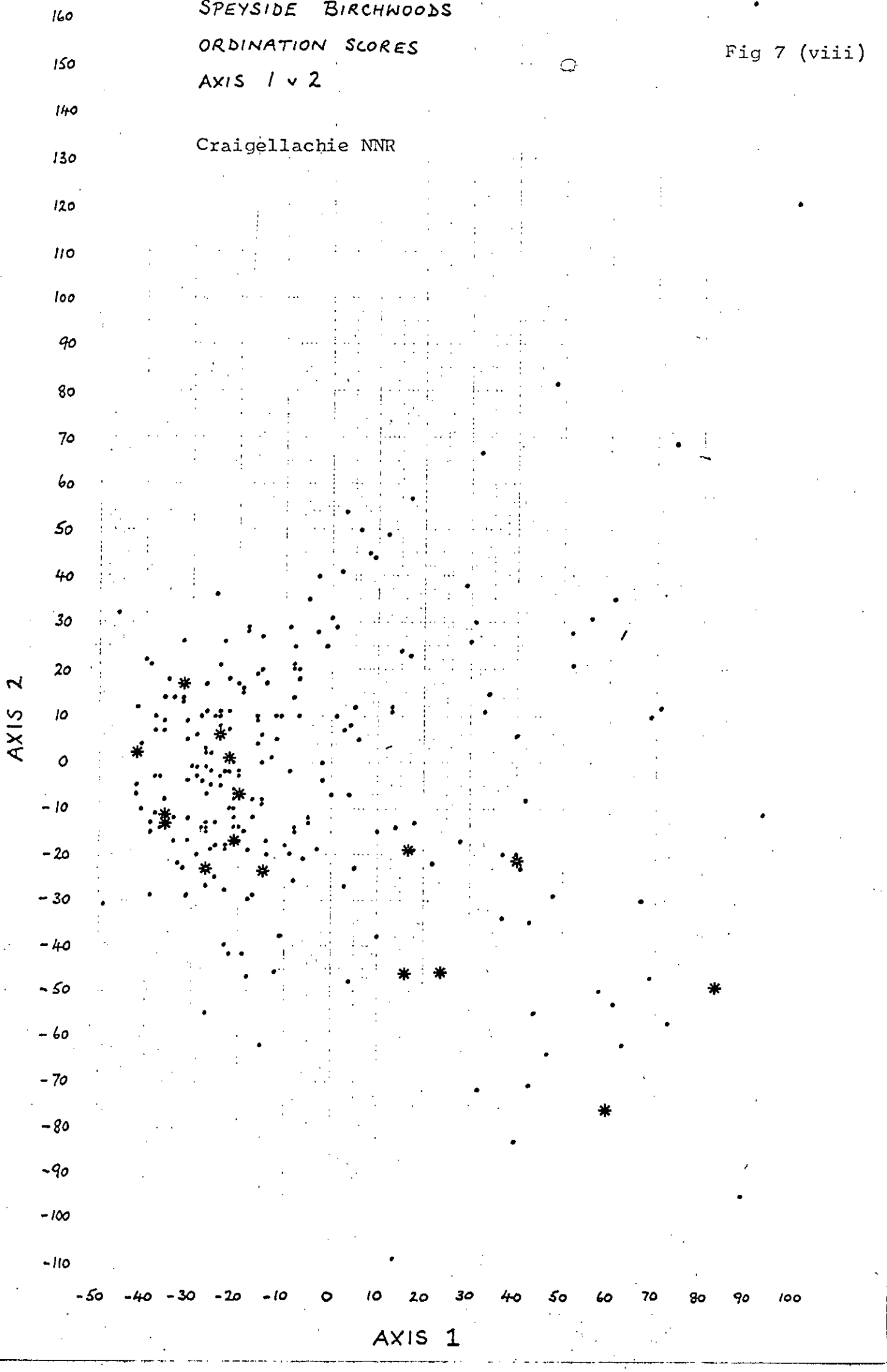
SPEYSIDE BIRCHWOODS

ORDINATION SCORES

AXIS 1 v 2

Fig 7 (viii)

Craigellachie NNR



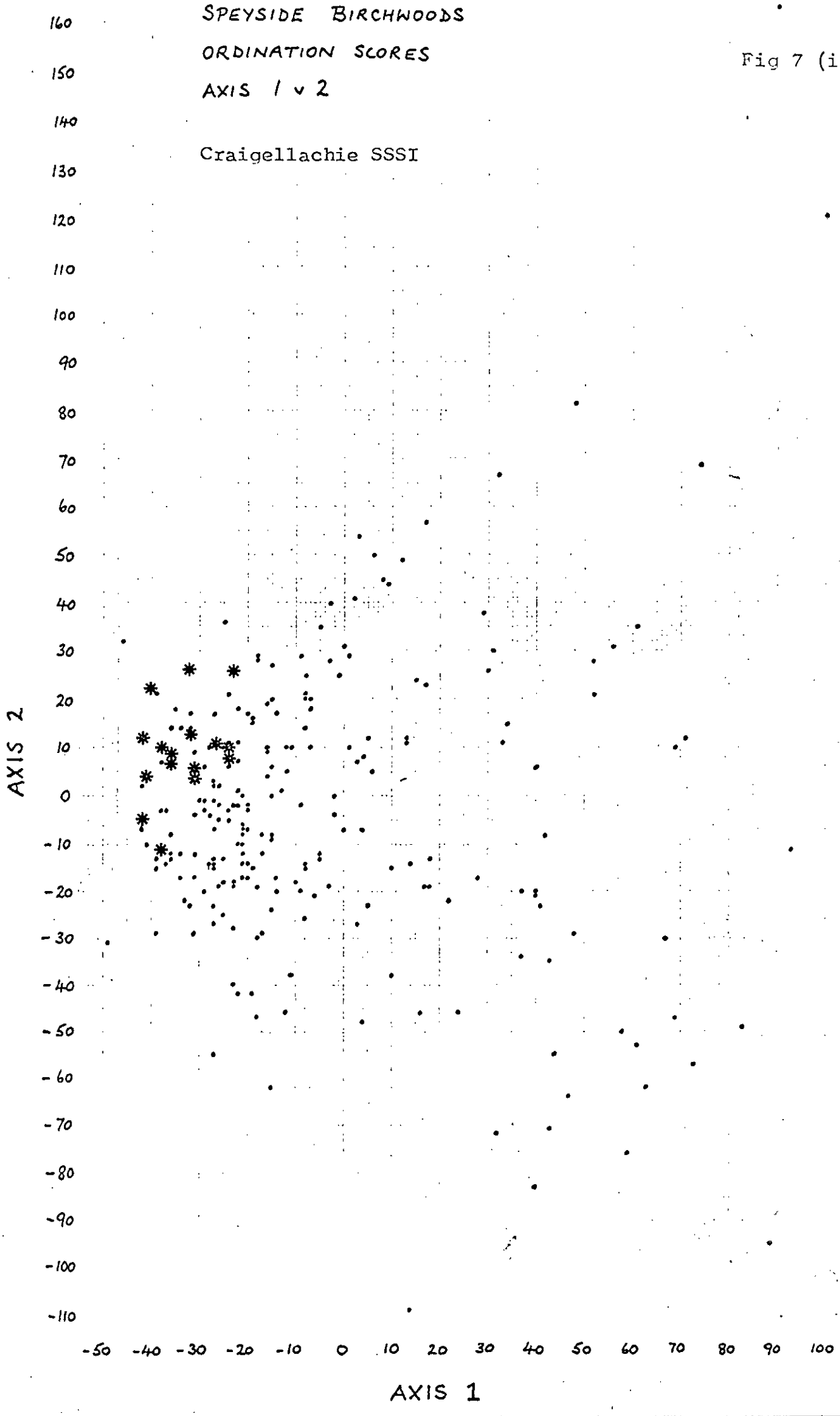
SPEYSIDE BIRCHWOODS

ORDINATION SCORES

AXIS 1 v 2

Fig 7 (ix)

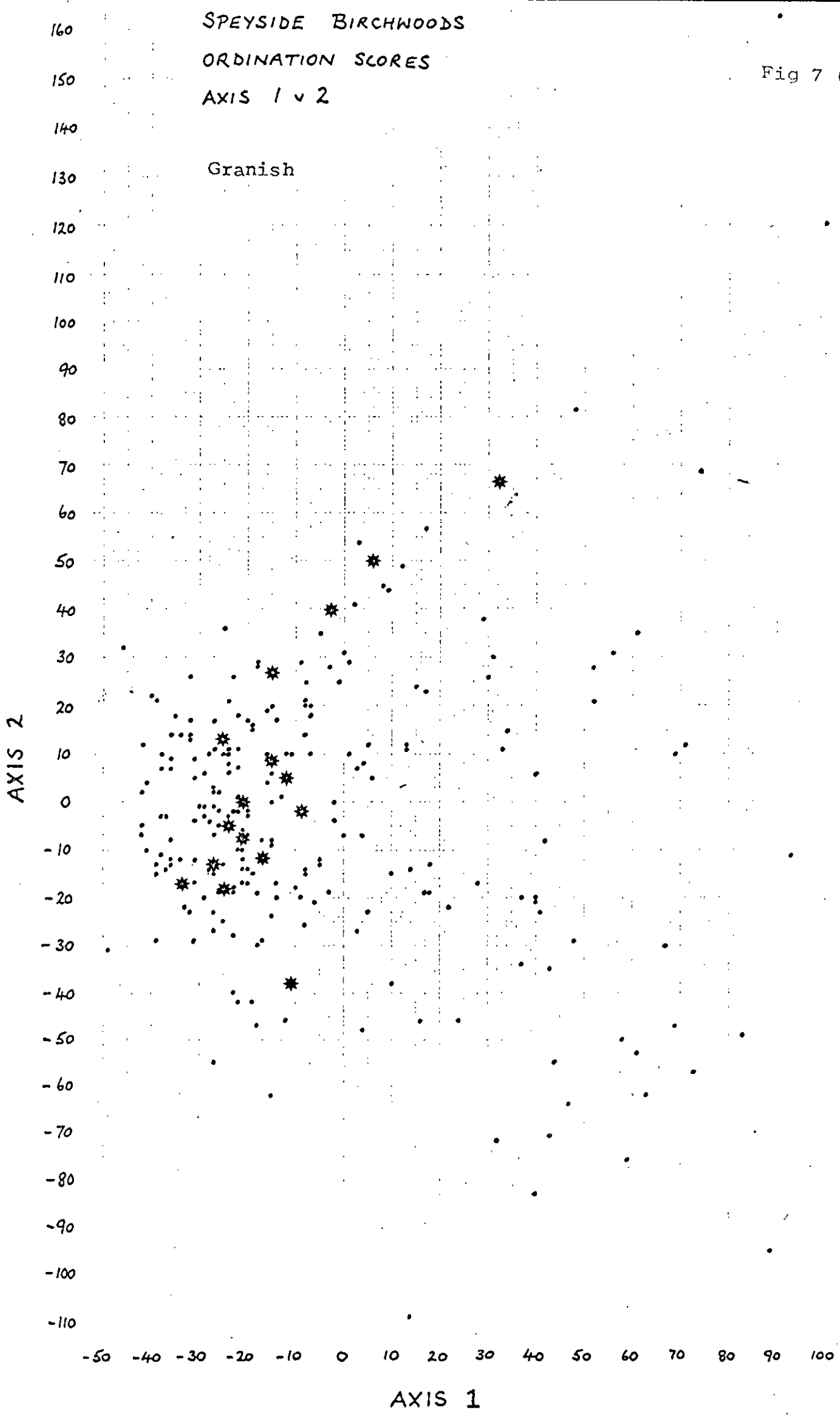
Craigellachie SSSI



SPEYSIDE BIRCHWOODS
ORDINATION SCORES
AXIS 1 v 2

Fig 7 (x)

Granish

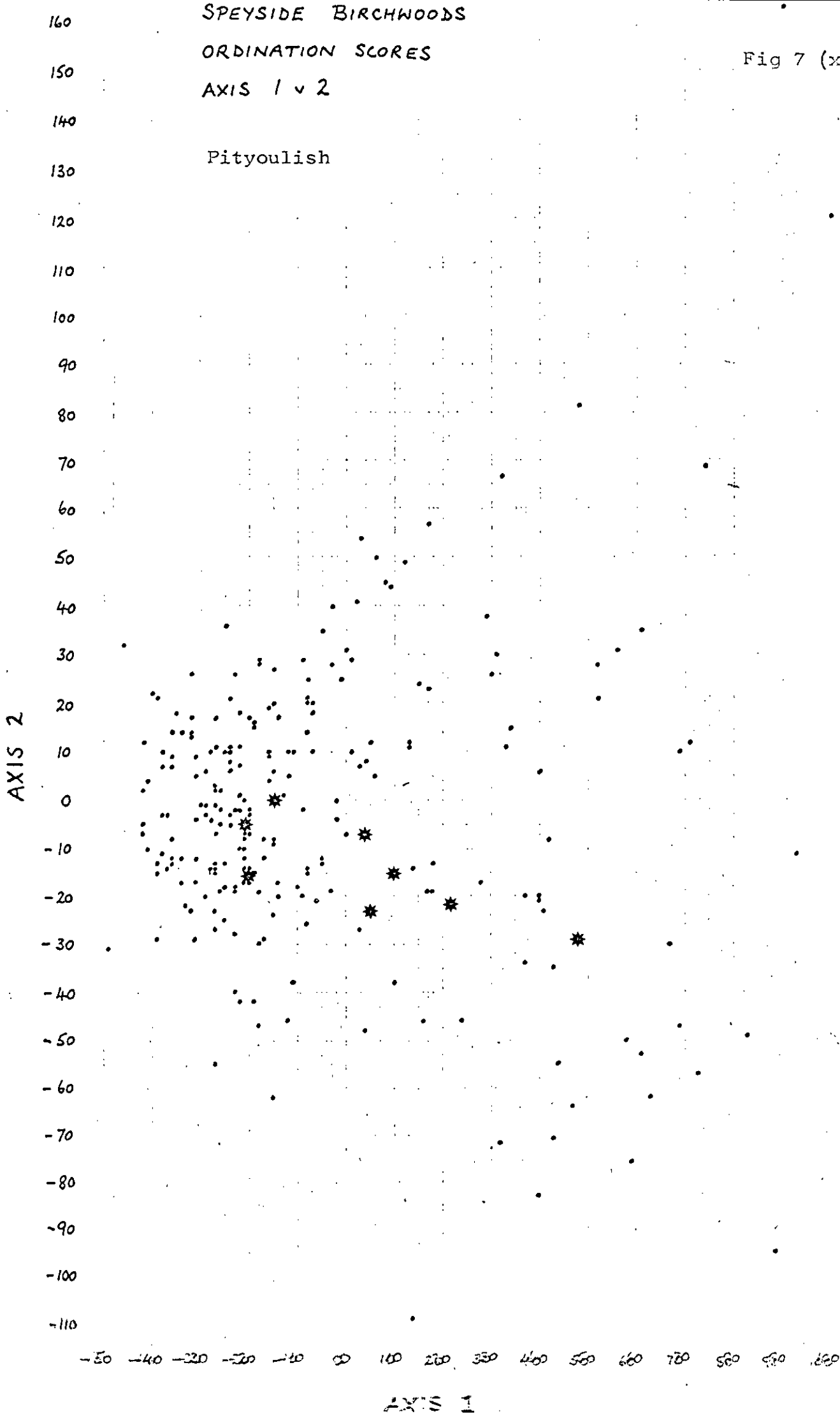


SPEYSIDE BIRCHWOODS

ORDINATION SCORES

AXIS 1 v 2

Fig 7 (xi)



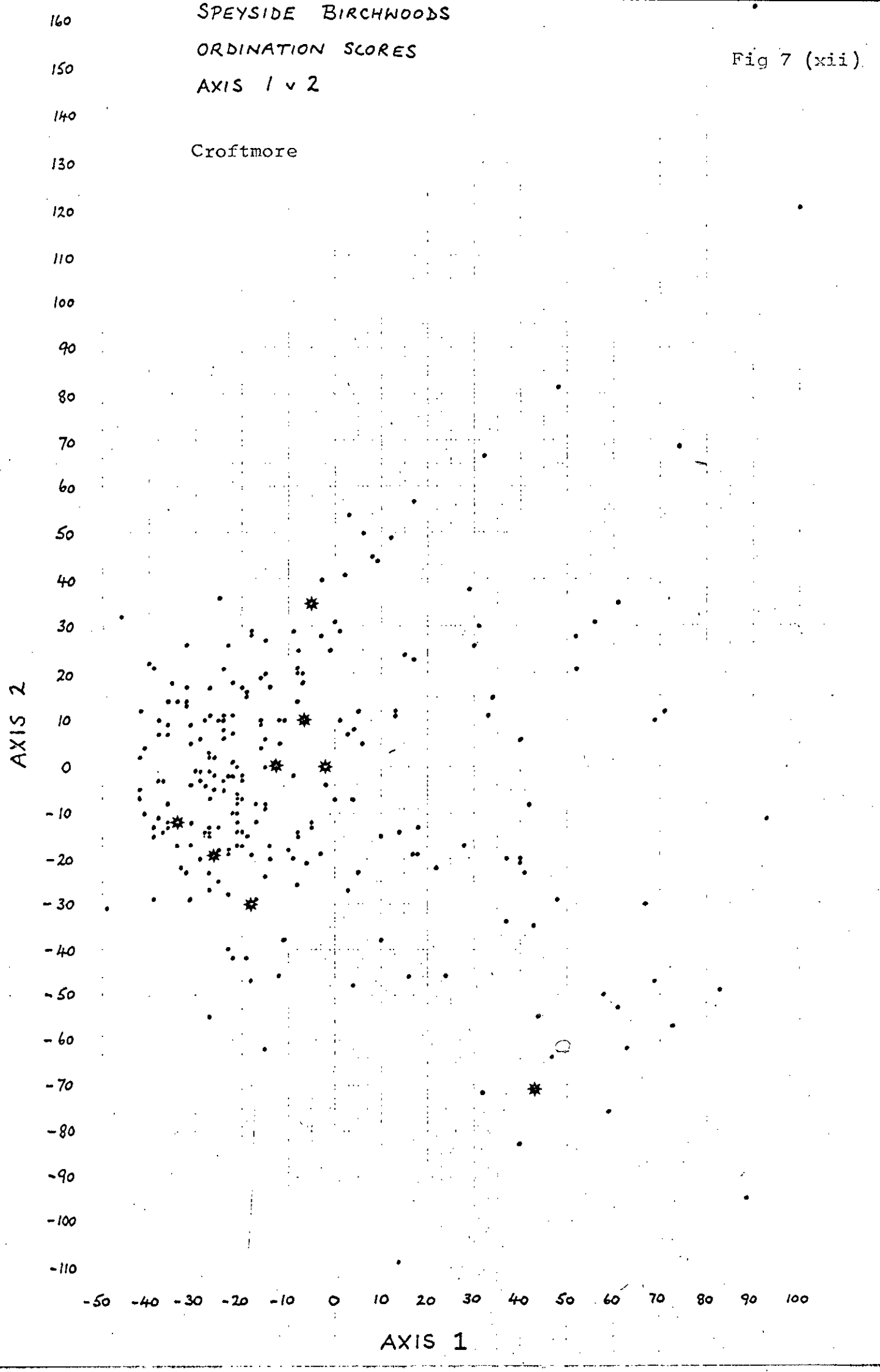
SPEYSIDE BIRCHWOODS

ORDINATION SCORES

AXIS 1 v 2

Fig 7 (xii)

Croftmore



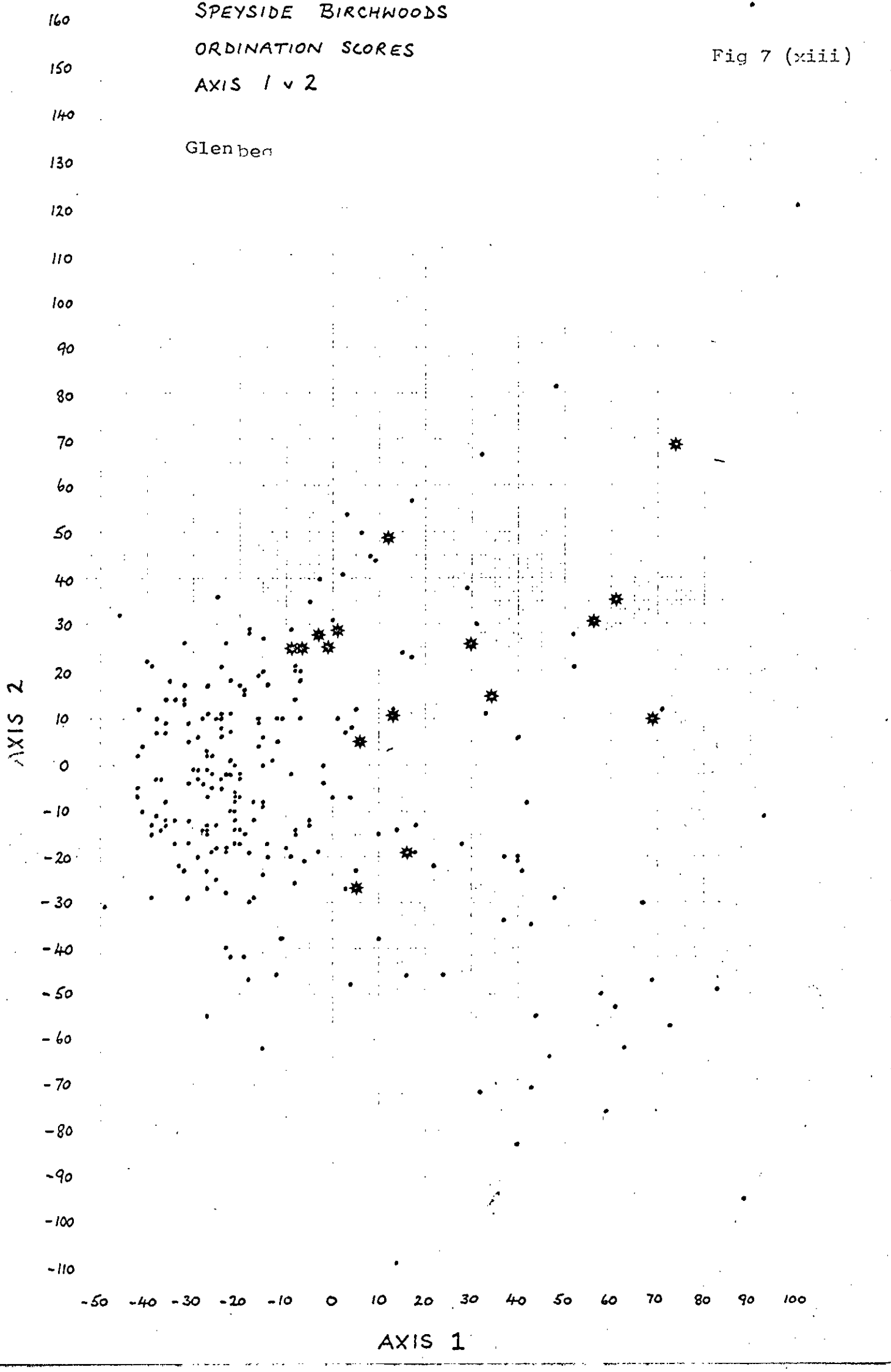
SPEYSIDE BIRCHWOODS

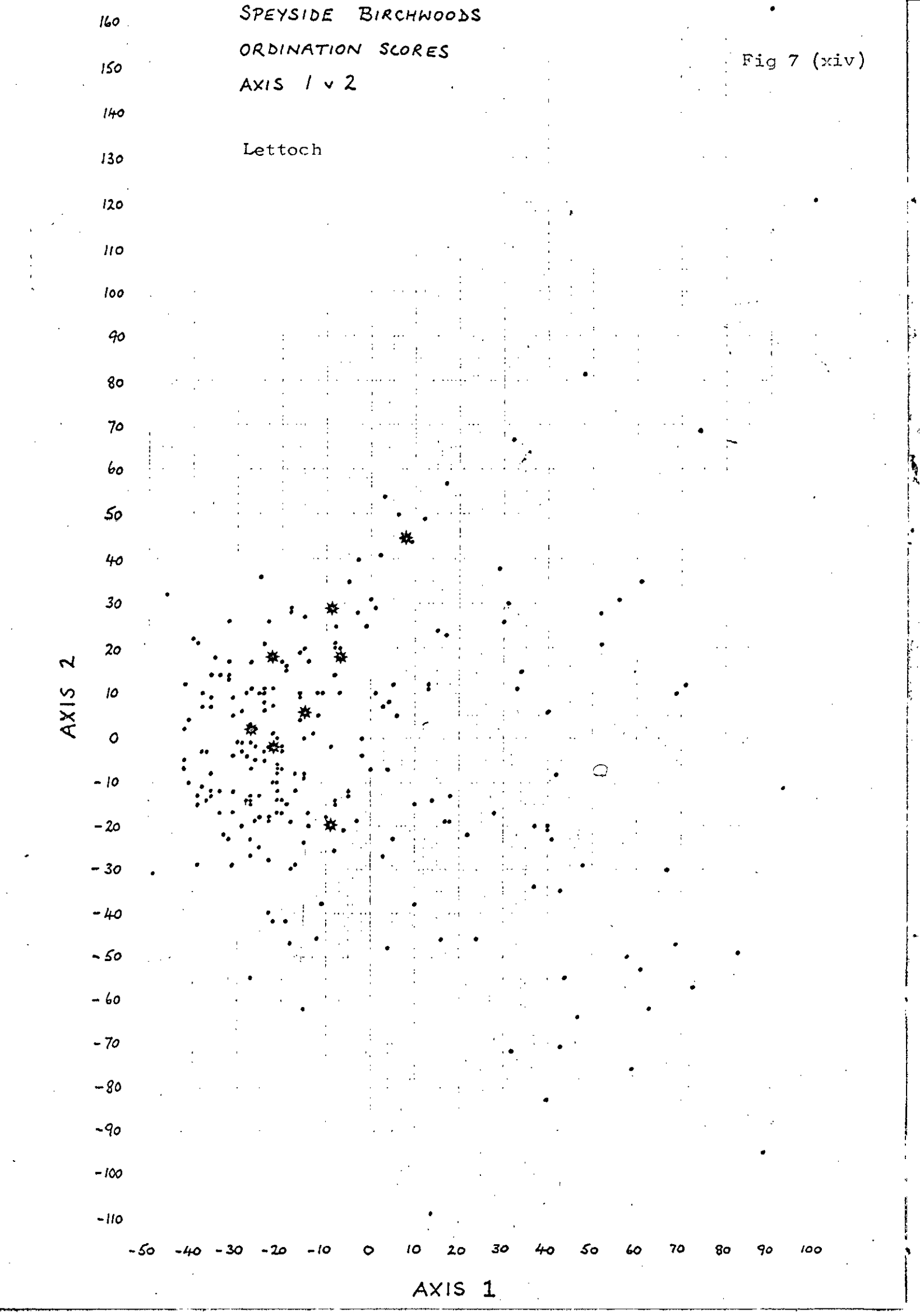
ORDINATION SCORES

AXIS 1 v 2

Fig 7 (xiii)

Glenben




SPEYSIDE BIRCHWOODS
ORDINATION SCORES
AXIS 1 v 2
Lettoch
Fig 7 (xiv)
AXIS 2
AXIS 1
160
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30
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50
60
70
80
90
100

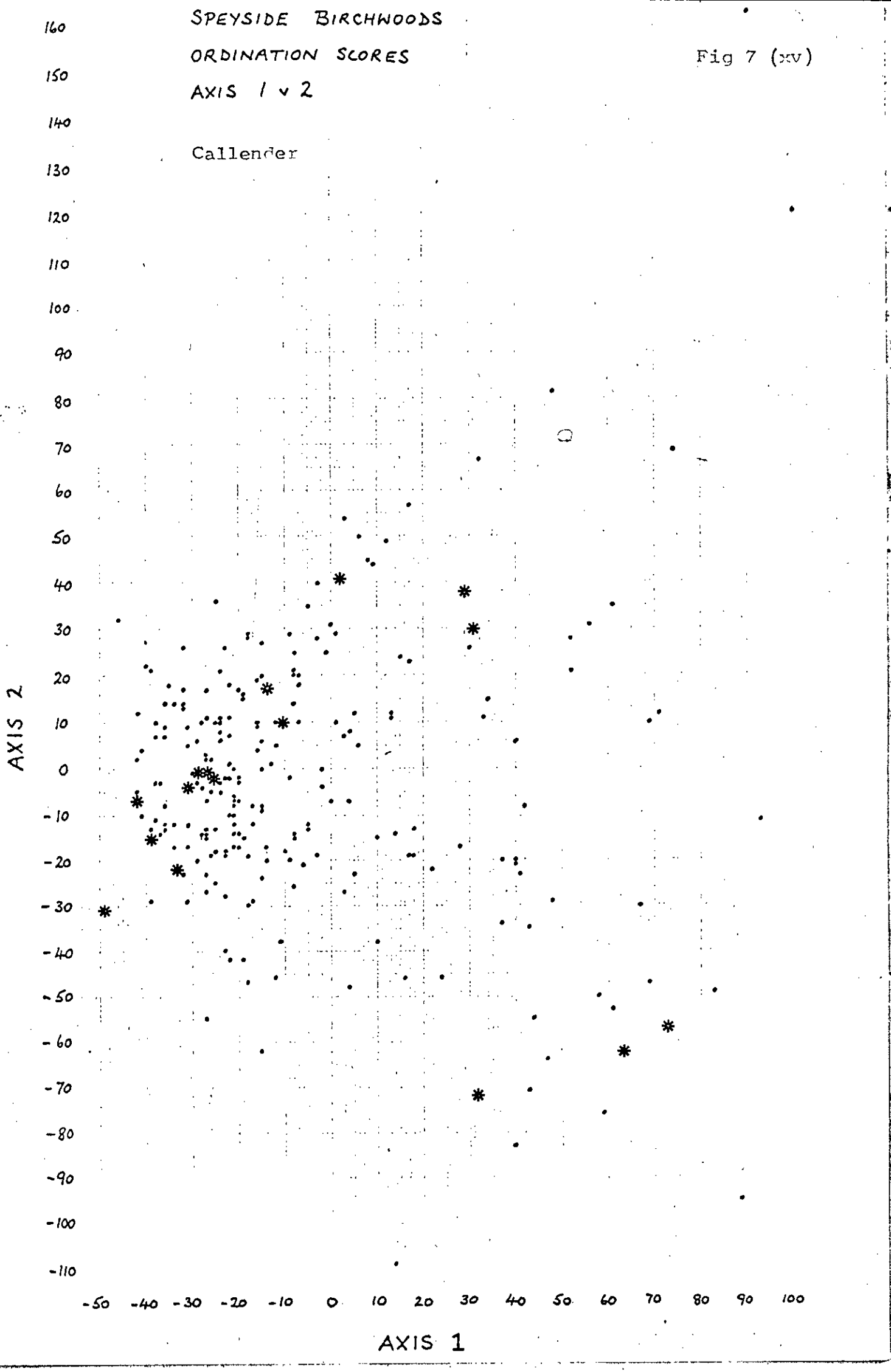
SPEYSIDE BIRCHWOODS

ORDINATION SCORES

AXIS 1 v 2

Fig 7 (xv)

Callender



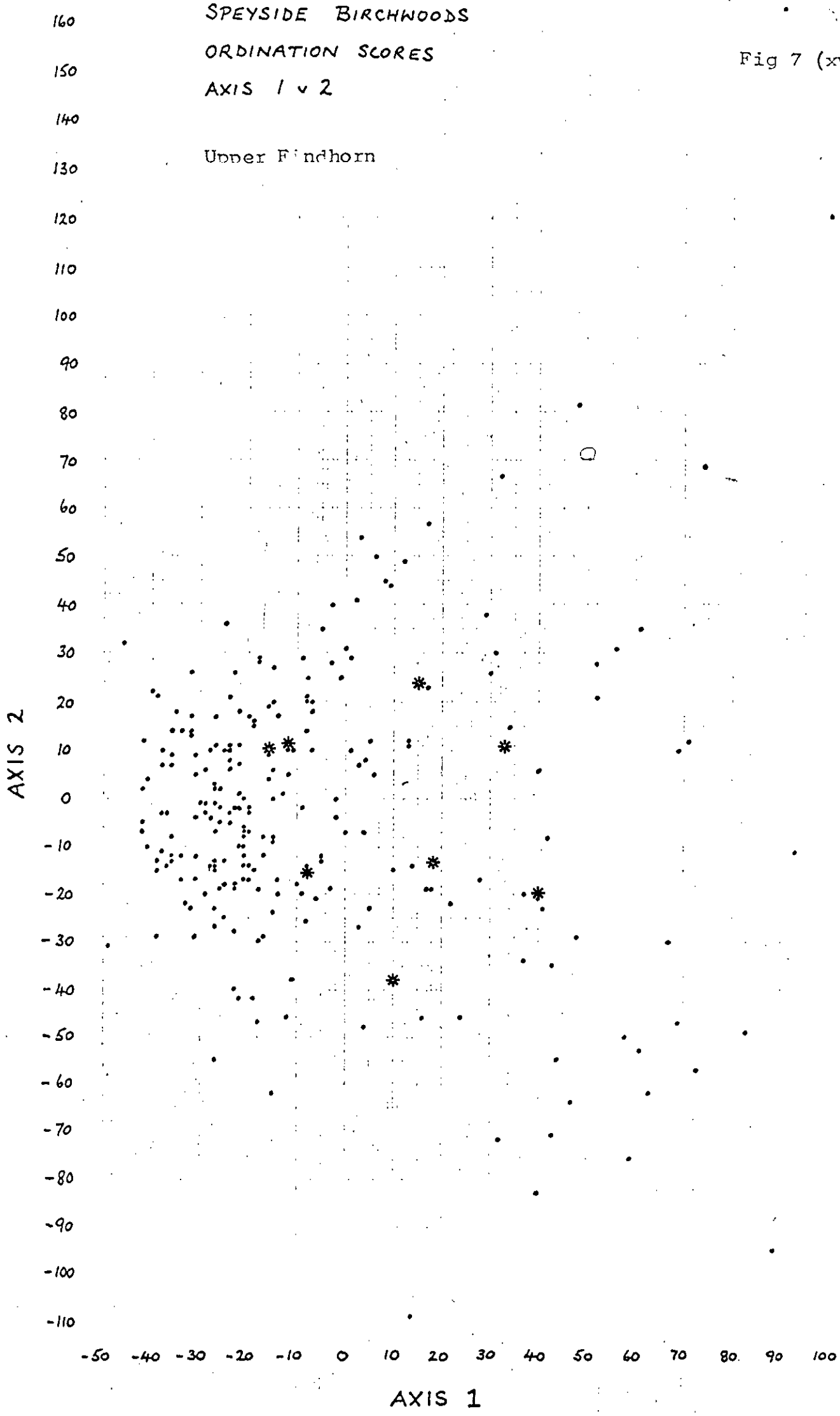
SPEYSIDE BIRCHWOODS

ORDINATION SCORES

AXIS 1 v 2

Fig 7 (xvi)

Upper Findhorn



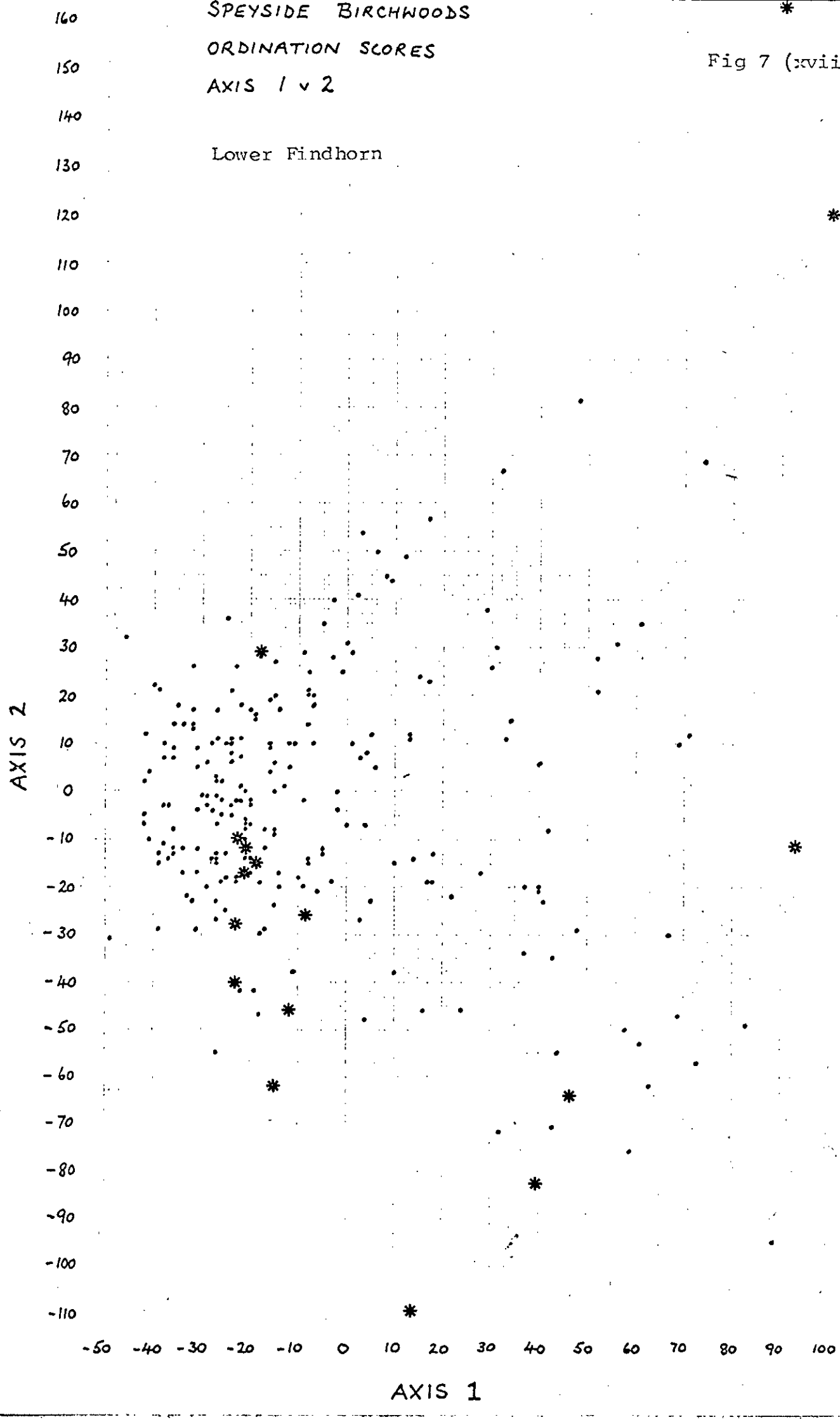
SPEYSIDE BIRCHWOODS

ORDINATION SCORES

AXIS 1 v 2

Fig 7 (xvii)

Lower Findhorn



SPEYSIDE BIRCHWOODS

ORDINATION SCORES

AXIS 1 v 2

Fig 7 (xviii)

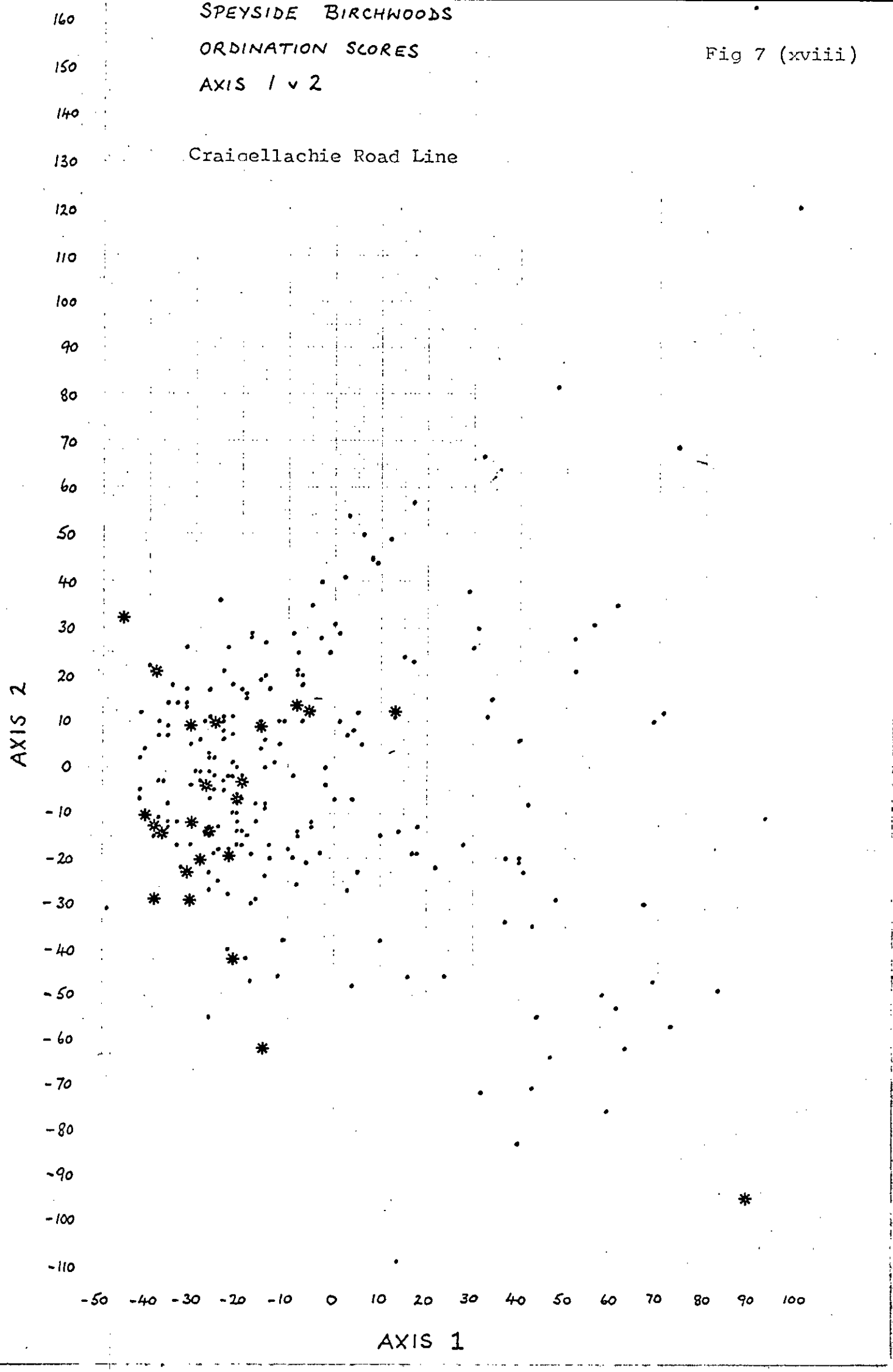


Table 1 - Mean values per site - ground flora and tree B.A.

Site	No. Plots surveyed	Total No. species	Mean No. species /plot	Mean BA (m^2/ha)
Spey Dam	8	124	53	11.1
Creag Dubhe	16	106	30	10.1
Glentromie	16	132	36	13.3
Craigbui	16	145	44	11.8
Dunachton	8	100	36	16.3
Alvie	16	90	24	18.3
Ord Ban	8	87	37	9.5
Craigellachie N.N.R.	16	145	41	8.4
Craigellachie S.S.S.I.	16	84	36	8.1
Granish	16	98	32	8.5
Pityoulish	8	88	37	16.8
Croftmore	8	83	32	11.6
Glenbeg	16	152	51	12.3
Lettoch	8	89	41	28.2
Callender	16	127	34	22.0
U. Findhorn	8	75	30	19.2
L. Findhorn	16	154	32	6.6
Craigellachie Road	24	122	30	10.3

Table 2 - % occurrence of trees: regeneration: and seedlings

Site	Trees		Regen		Sdlgs	
	Birch	Other	Birch	Other	Birch	Other
Spey Dam	100	0	0	0	88	100
Creag Dubhe	81	0	13	13	38	31
Glentromie	63	44	19	19	63	38
Craigbui	100	63	19	19	50	13
Dunachton	88	63	50	38	50	38
Alvie	94	69	6	50	50	38
Ord Ban	100	0	0	0	50	50
Craigellachie N.N.R.	81	6	44	31	56	50
Craigellachie S.S.S.I.	94	38	19	38	44	69
Granish	88	19	69	0	69	63
Pityoulish	75	50	38	63	50	75
Croftmore	88	25	50	38	50	75
Glenbeg	94	25	0	13	56	100
Lettoch	75	38	25	0	63	100
Callender	100	44	75	56	44	100
U. Findhorn	100	50	0	0	25	38
L. Findhorn	63	25	75	19	75	81
Craigellachie Road	96	4	58	13	67	33

Table 3 - Habitat and Environmental data

Site	Mean No. habitats /plot	Mean altitude (ft) of plots	Mean slope	Mean pH
Spey Dam	18	1338	27	5.2
Creag Dubhe	12	1059	16	4.8
Glentromie	15	1100	15	5.0
Craigbui	17	991	12	5.0
Dunachton	15	931	12	4.9
Alvie	9	903	17	4.4
Ord Ban	12	1031	21	5.1
Craigellachie	14	888	17	4.6
Craigellachie S.S.S.I.	13	875	26	5.0
Granish	13	744	7	4.7
Pityoulish	15	819	17	5.0
Croftmore	12	719	11	5.0
Glenbeg	18	906	15	5.0
Lettoch	15	688	24	5.0
Callender	15	603	22	4.3
Upper Findhorn	16	1150	9	4.2
Lower Findhorn	11	572	8	4.2
Craigellachie Road	14	775	17	4.5

Table 4 - % occurrence of each group in each site (8 Group level)

Group	1	2	3	4	5	6	7	8
Site								
1	13	13			50		25	
2	13	6	19	25	31			6
3	13	13		19	6	13		31
4	13			19	13	13	13	6
5		13	50	13		13	13	
6	56	19	6	19				
7			75	13	13			
8	19	13	25	13	6		6	19
9			13	81	6			
10	13	13	50		6	13	6	
11	13	13	13		13		50	
12		13	75			13		
13			6		50	6	31	6
14			38	13	50			
15	25	6	19	19	19			13
16	38				25	13	25	
17	25	44	6		6	13		6
18	29	13	33	13	4		8	

Table 5 - % occurrence of each group in each site (4 Group level)

Group	1	2	3	4
Site				
1	25		50	25
2	19	44	31	6
3	25	25	19	31
4	13	44	25	19
5	13	63	13	13
6	75	25		
7		88	12	
8	31	38	6	25
9		94	6	
10	25	50	19	6
11	25	13	13	50
12	13	75	13	
13		6	56	38
14		50	50	
15	31	38	19	13
16	38		38	25
17	69	6	19	6
18	42	46	4	8

Appendix 1 - List of Sites included in the survey

Site Number	Site	Map Reference at centre
1	Spey Dam	NN/555922
2	Creag Dubhe	NN/700995
3	Glentromie	NN/775965
4	Craigbui	NH/790030
5	Dunachton	NH/810051
6	Alvie	NH/872086
7	Ord Ban	NH/891085
8	Craigellachie NNR	NH/888126
9	Craigellachie SSSI	NH/886109
10	Granish	NH/900150
11	Pityoulish	NH/925140
12	Croftmore	NH/941148
13	Glenbeg	NJ/010282
14	Lettoch	NJ/095323
15	Callender	NJ/150370
16	Upper Findhorn	NH/802259
17	Lower Findhorn	NH/935434
18	Craigellachie Road*	NH/891119

* These plots were specially surveyed in connection with an ecological assessment of possible alternative routes for the A9 trunk-road.